SIGNAL

October 1960

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The New Industrial College

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Commandant

See page 33

PHILCO ANNOUNCE

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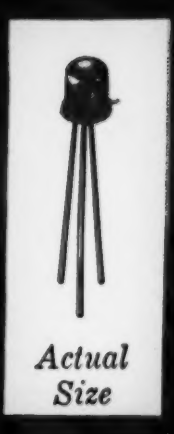

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Total Device Dissipation at 25°C	60 mw

ELECTRICAL CHARACTERISTICS (T=25°C)

haracteristics	Min.	Typ.	Max.	
Cutoff Current, I_{CBO} (V_{CB} = −5v)		1.0	3	μa
nt Amplification Factor, h_{FE} (V_{CE} = −0.5v, I_C = −10 ma)	50	90	200	
tage, V_{BE} (I_C = −10 ma, I_B = −0.5 ma)	0.29	0.33	0.36	volt
Saturation Voltage, V_{CE} (SAT) (I_C = −10 ma, I_B = −0.5 ma)	.09	0.12	0.16	volt
equency Characteristics				
apacitance, C_{ob} (V_{CB} = −3v, I_E = 0, f = 4 mc)		1.9	2.5	μμf
acitance, C_{ib} (V_{EB} = −1v, I_C = 0, f = 4 mc)		6.0	10	μμf
dwidth Product, f_T (V_{CE} = −5v, I_E = 7 ma)	320	450		mc
g Characteristics				
, t_r (β_C = 10)		13	18	mμsec
age Factor, K'_s		39	50	mμsec
, t_f (β_{CO} = 10)		10	18	mμsec

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2N501	Ultra High Speed Switch (Storage Temperature, 85 C)
2N501A	Ultra High Speed Switch (Storage Temperature, 100 C)
2N504	High Gain IF Amplifier
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"Project Echo" satellite went into a near-perfect circular orbit 1000 miles high, circling the earth once every two hours. Its orbital path covered all parts of the U. S.

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Think of watching a royal wedding in Europe by live TV, or telephoning to Singapore or Calcutta—*by way of outer-space satellites!* A mere dream a few years ago, this idea is now a giant step closer to reality.

Bell Telephone Laboratories recently took the step by successfully bouncing a phone call between its Holmdel, N. J., test site and the Jet Propulsion Laboratory of the National Aeronautics and Space Administration (NASA) in Goldstone, California. The reflector was a 100-foot sphere of aluminized plastic orbiting the earth 1000 miles up.

Dramatic application of telephone science

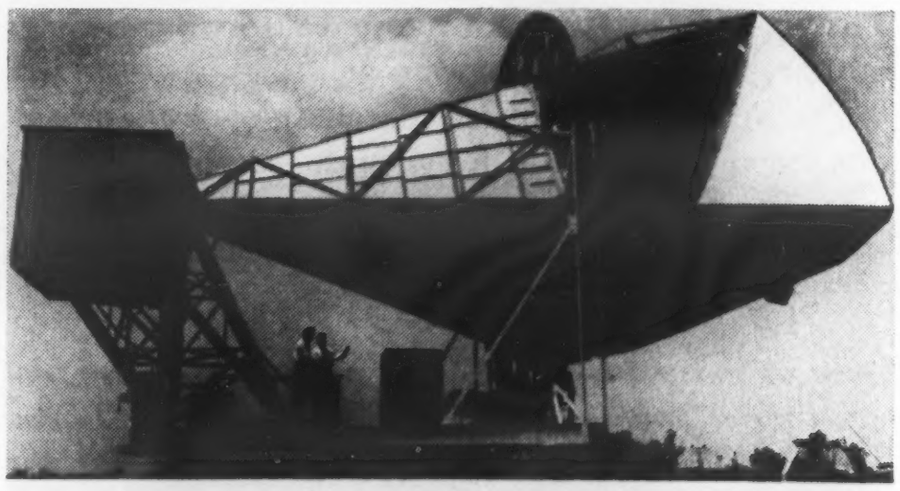
Sponsored by NASA, this dramatic experiment—known as "Project Echo"—relied heavily on telephone science for its fulfillment . . .

- The Delta rocket which carried the satellite into space was steered into a precise orbit by the Bell Laboratories Command Guidance System. This is the same system which recently guided the remarkable Tiros I weather satellite into its near-perfect circular orbit.

- To pick up the signals, a special horn-reflector antenna was used. Previously perfected by Bell Laboratories for microwave radio relay, it is virtually immune to common radio "noise" interference. The amplifier—also a Laboratories development—was a traveling wave "maser" with very low noise susceptibility. The signals were still further protected from noise by a special FM receiving technique invented at Bell Laboratories.

"Project Echo" foreshadows the day when numerous man-made satellites might be in orbit all around the earth, acting as 24-hour-a-day relay stations for TV programs and phone calls between all nations.

This experiment shows how the Bell Telephone System is working to advance space communication. Just as we pioneered in world-wide telephone service by radio and cable, so we are pioneering now in using outer space to improve communications on earth. It's part of our job, and we are a long way toward the goal.



Giant ultra-sensitive horn-reflector antenna which received signals bounced off the satellite. It is located at Bell Telephone Laboratories, Holmdel, New Jersey.

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COVER

The new home of the Armed Forces Industrial College was dedicated recently by President Eisenhower in ceremonies at Ft. Lesley J. McNair. Lt. Gen. George W. Mundy, USAF, is Commandant of the College. The mission of the College is to conduct courses of study in the economic and industrial aspects of national security.

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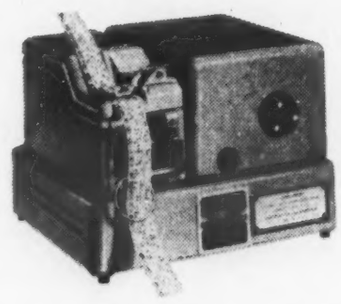

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the elements of Command Control:

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The measure of any command control system is time. Success depends on how fast the system can close the loop between detected action and counter-action. Command control begins with data acquisition and ends with data application. Here, IBM's experience encompasses subsystems for the acquisition of information from distant and varied sensing devices, and for the presentation of refined data to commanders for military action.

Data Communication
High-speed networks that link command control computers require facilities to assemble and direct masses of data. Time is important. IBM data communication capabilities are evident in systems such as SABRE, a real-time activity control network; and INFORMER, a rugged, mobile field control center. These systems employ communication techniques involving real-time data channels, data conversion and message switching.

Data Processing and Control
Information must be quickly reduced and refined through computer processing to prepare it for command decision. Here again time is paramount. IBM has solved special data processing problems with standard systems such as the 709, installed for space vehicle orbit computations, and advanced systems such as the AN/FSQ 31V, in production for the Strategic Air Command Control System.

...all systems capabilities of IBM

IBM solutions to command control requirements range in scope from antisubmarine warfare studies to Air Force control systems like project 473L, and from the compact INFORMER to STRETCH, the world's largest computer. From study to implementation, IBM has proved its ability to solve the problem of time in all three elements of command control systems.

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1538

Premature Disarmament Our Greatest Danger

W. J. BAIRD
General Manager and Editor

THE DISTRESSING CONSEQUENCES OF our rapid demobilization following World War II should provide sufficient warning when planning for future disarmament. This was an unfortunate unilateral action which was not duplicated by the Soviets. Let us hope we have learned our lessons, let us hope also that we have come to the realization that the key to any lasting peace settlements lies in keeping our preparedness at parity with that of any potential aggressor. If we are given the opportunity to make peace through disarmament by honest and reasonable negotiations, we must first make certain of our readiness to enforce that peace.

Mr. Khrushchev would have us think that he alone is the true conveyor of peace through disarmament but what he doesn't say outright is that disarmament must be accomplished on his terms. If we should ever be so foolhardy as to accept rapid disarmament now, we will lose our shirt, make no mistake about it. In this nuclear era, there is no surer way to create a position of strength without teeth, where swift and widespread destruction makes the rebuilding of a respectable military machine impossible. It would be tragic for the United States and, in fact, all of the Free World if we confused the true realities of the disarmament problems facing us today with the hard facts of what must be done. Any form of disarmament presages an evaluation of the national capabilities to rectify this action, should we be attacked. To rearm and institute a program for survival demands speed of execution. It must be initiated before, not after, the explosion occurs. Procrastination is as fatal as incompetence. This is why a serious estimate of the situation must preface any decision regarding premature disarmament regardless of what public opinion may demand. Let us not lose sight of the fact that as long as Red China remains outside the United Nations, equality of armament is mandatory. We can only disarm with checks and balances, not by degrees. No one knows better than Mr. Khrushchev that his form of disarmament can succeed only by beating us down with skillfully directed propaganda designed to discredit us before the world. If he believes this and we recognize that he does, the importance of remaining strong becomes axiomatic.

We must launch our future plans and national objectives from a position of strength, both economic and military. Once the national economy is disrupted, once the shortages and bottlenecks in defense production appear, it becomes a wild and futile scramble to correct the situation. Time is no longer on our side, we cannot afford the preoccupation of this wild melee which has characterized some of our previous performances. In meeting important problems we must present a united and solid front. We must sharpen to a razor edge our ability to think quickly on debatable issues. With this flexibility coupled with a strong core of military preparedness, we will maintain not only our self-respect with any potential aggressor but go a long way in securing the peace.

Through the recent gathering at the United Nations, we are all aware of the current peace and disarmament talks. The world is talking of little else. We anxiously await future developments and fervently hope that the light of peace may dispell at least some of the shadows of war. But during this contest between statesman on the issue of disarmament, we must not be lulled into false security. Of one thing we can be sure, any peace in our time, any settlement even remotely conceivable must be a guarded one. We would have to watch over it constantly so that it could not be broken with catastrophic surprise.

Neither is this the time for reckless reduction in our defenses and of those of our allies. We cannot afford to disorganize our forces in being or to de-emphasize military preparedness. America must stay strong and push ahead for those essentials necessary for national military equality and for the rapid modernization of our forces.

Stating it another way, before we can talk of peace seriously we must make sure that the mistakes of the past will not be repeated. Mistakes which have rocked the very foundation of our national posture in men, material and money.

In conclusion I would like to say a word about the Industrial College of the Armed Forces and its role in national affairs. It is my unequivocal and firm conviction that no other single institution in our country, specializing in the social, economic and military studies of all nations of the world, is as expertly equipped or as competent to train for future military and civilian government leaders in all aspects of national security. The educational staff of military and civilian instructors and its traveling lecture teams under the capable leadership of its Commandant, Lieutenant General George W. Mundy, USAF, perform a mission which from a national security viewpoint is reassuring. Unmistakably outstanding, this highest institution of military learning gives its graduates a balanced perspective on essential data so vital and necessary in strengthening our national security. I recommend to all industrialists, business executives, educators, scientists, religious leaders and particularly to the readers of SIGNAL Magazine, the article on the Industrial College which appears on page 33 of this issue.

A PROPOSAL FOR PAN-AMERICAN TELECOMMUNICATIONS

PROMPT ESTABLISHMENT OF A MODERN, HEMISPHERE-WIDE TELECOMMUNICATIONS SYSTEM IS ESSENTIAL TO THE MUTUAL UNDERSTANDING, ECONOMIC DEVELOPEMENT, DEFENSE AND ACTUAL SURVIVAL OF THE AMERICAS.

by

GEORGE P. AND EVELYN F. ADAIR
George P. Adair Engineering Company

OUR LATIN AMERICAN friends have come to the fork in the road. Without assistance they can easily take the road to the left and sink into chaos and communism or with the proper understanding, encouragement and assistance take the road to the right and develop their vast natural resources and abilities into stable governments and economies with high standards of living for the masses as well as the privileged few. Status quo is no longer possible.

Millions of words have been spoken and written, largely with tongue in cheek, about the Good Neighbor Policy among the twenty-one sovereign nations of the Pan American Union and about the lack of understanding between the peoples of these countries particularly between those of the United States and its Latin American neighbors. A considerable amount of money and effort has been directed towards the economic factors involved and apparently this is being increased. However, very little has been done towards correcting the fundamental lack of understanding between the peoples of these countries. While it is true that there is considerable contact between the officials and the more prominent citizens of the countries, there is relatively little contact between the great masses which is essential to proper understanding. There have been some exchanges by means of motion picture films. Unfortunately by and large the United States' films distributed in these countries have led their viewers to believe the United States is composed of cowboys, gangsters and millionaires. This impression is not only true in Latin America but is a world-wide impression which is most regrettable and certainly untrue.

International broadcasting through the "Voice of America" has helped a great deal. However, even this falls far short of reaching the masses to the extent it should. There is a relatively poor distribution of short-wave receivers and furthermore the "Voice" is well known as a governmental operation. Therefore, it is viewed with considerable suspicion as some of these people have been deceived too many times by pronouncements of their own governments.

North American tourists in the Latin American countries are increasing in number and will increase much more rapidly when the Pan American Highway is completed. However, here again, this will always include only a relatively small percentage of the North American people and the contacts of these tourists with the peoples of the host countries are relatively minor. Only too often these brief contacts result in further misunderstanding rather than in improved understanding.

Understanding between the peoples does not mean, nor is it necessarily even desirable, that Latin Americans become like the people of the United States or vice versa. However, each have certain qualities which the other would do well to adopt. It is not necessary for one people to adopt the customs of another, but it is necessary for them to develop a mutual understanding and tolerance by knowing and understanding that they are all humans with many of the same basic desires and problems.

An Intercontinental System

It is obvious that a more intimate and broader means of communication between the peoples of the several countries of the Americas must be found. A major step toward solution of this would be the establishment of a telecommunication system covering both continents and the Caribbean Islands, linking all the countries together. This would not only provide a means of improved social and cultural contact between the various peoples but also is an absolute necessity to the advancement of the economies of the several countries and the defense of the Western Hemisphere.

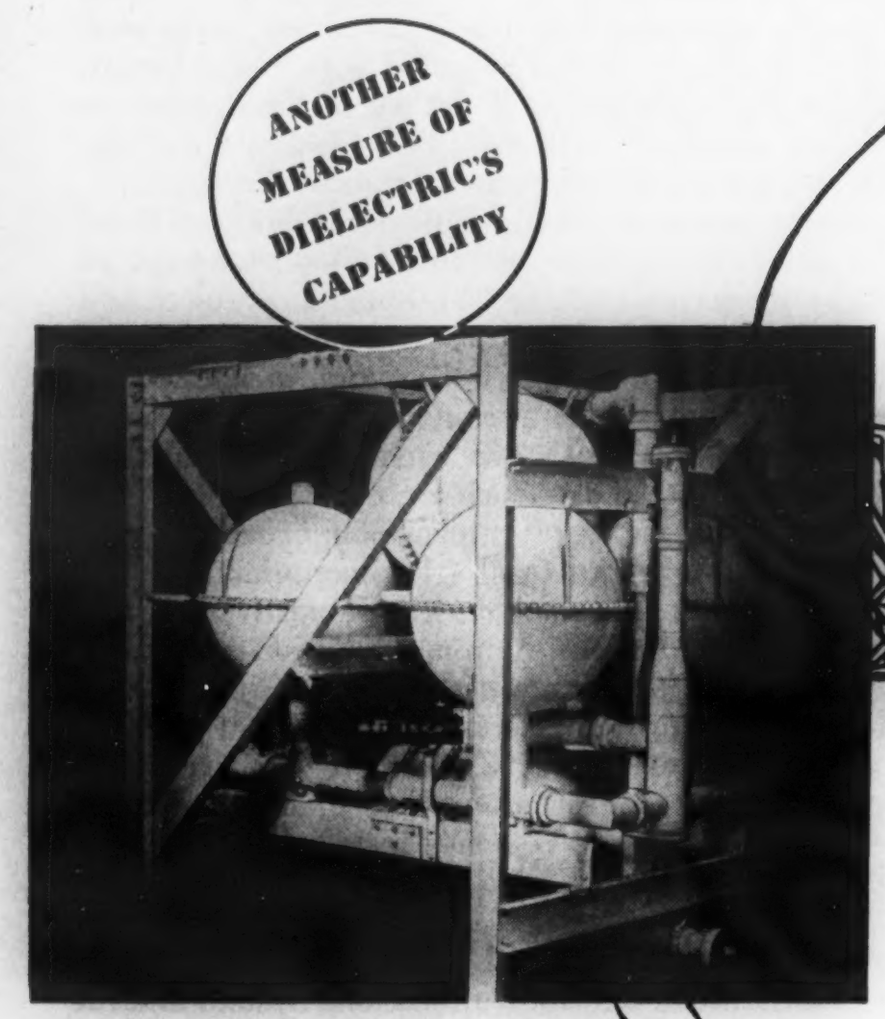
Insofar as the cultural and social contacts between the peoples are concerned, a hemisphere-wide telecommunications system would provide a ready means for the exchange of radio and television broadcast programs. All of the countries are well supplied with radio broadcast stations and a majority, if not all of them, have or are installing television stations. The economic and defense advantages are too obvious to require discussion.

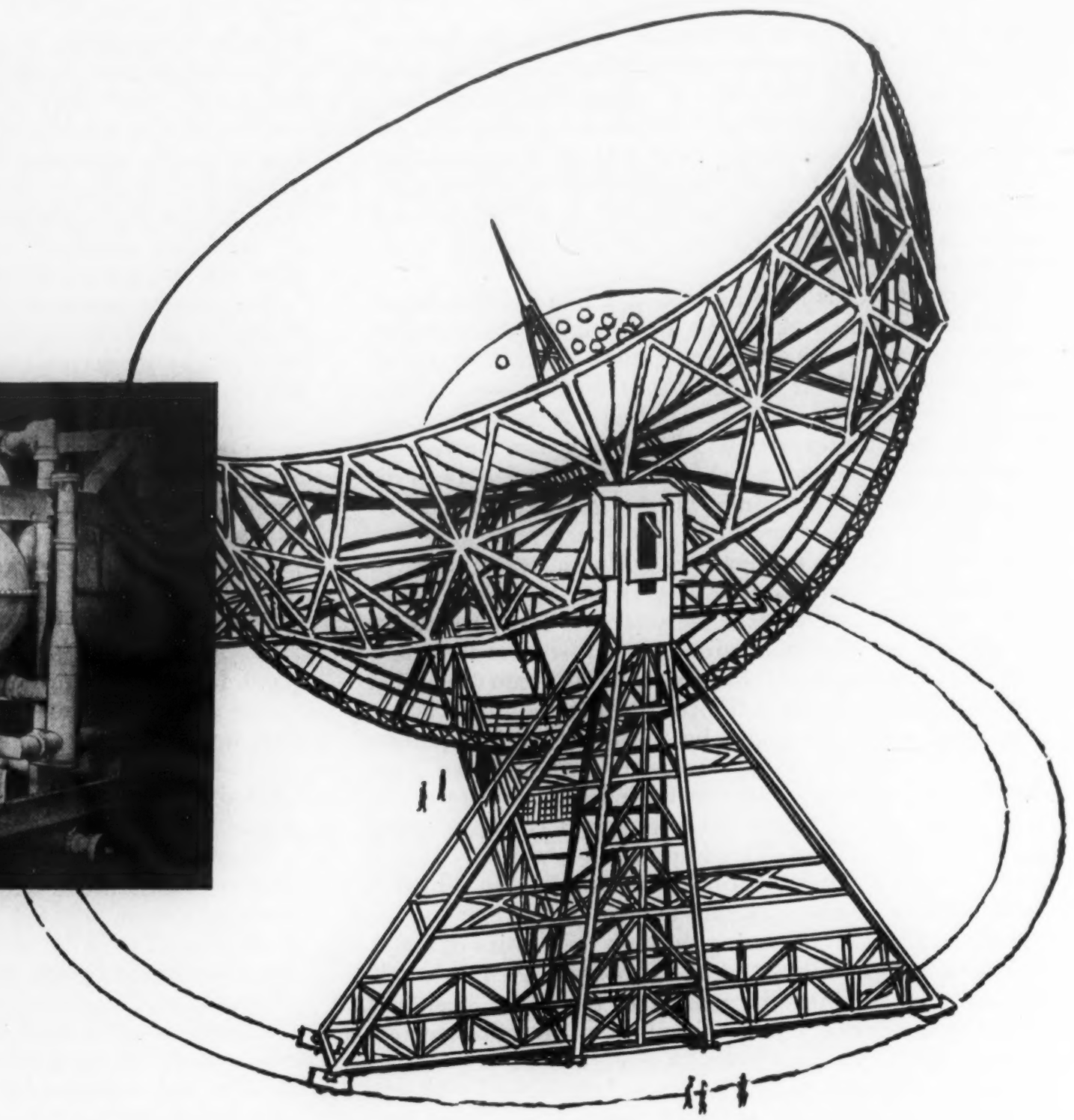
The present means of telecommunication between these countries and between them and the United States are in general (by modern standards) antiquated, obsolete and wholly inadequate. They consist largely of slow-speed cables, short wave radio transmissions and, in some cases, antiquated wire lines which are totally unsuited for modern communication. These are usually inadequate for telephone, telegraph, and teleprinter operations and unusable for radio broadcast or television broadcast purposes. In addition the internal telecommunications systems of many of the Latin American countries are also inadequate and need rehabilitation, expansion and extension. A number of these countries are installing or have plans for major improvements and expansion of their internal communications systems, but there is a great deal that needs to be done even after these plans are carried out. A high speed cable is being installed between the United States and Puerto Rico. This is only a step towards what is actually needed.

There are a number of methods of providing a satisfactory International Telecommunications System and the eventual system selected may employ any one of these or a combination of them all depending upon the circumstances and conditions found after an appropriate survey. Regardless of the method employed there will be many technical, geographical and personnel problems involved not only in the establishment but in the day to day operation and maintenance of the system. However, these can be solved relatively easily if and when two other problems are solved. The first of these is the establishment of a satisfactory and acceptable controlling and operating organization and the other is the obtaining of adequate financing.

An International Organization

Since more than twenty sovereign countries are involved it is not believed that the international trunk routes of the system can be satisfactorily operated on a national basis. Apparently the only satisfactory method of operation is to form an international organization of sufficient stature, ability, authority and responsibility to operate the system as a whole. It is realized, that in the establishment of such an organization, a certain amount of sovereignty must be relinquished by each country but on the other hand much greater benefits will be provided to each country. This organization must have adequate representation from each participating country and must have safe-guards against changes in government, political interference, graft and other factors which might adversely affect its operation. It must be an effective and efficient business organization and held fully accountable for its actions. Possibly this could be a commercial organization wholly owned by private interests to which each country would give a long term franchise. However, the very large initial investment required and the probability of





THIS UHF DIPLEXER NETWORK was built by **DIELECTRIC** Products Engineering Company, Inc., under contract from Space Technology Laboratories, Inc. It is now installed in the tower of the single giant antenna of "SpaN Net's" Jodrell Bank radio telescope at Manchester, England Its function is . . .

isolating simultaneous signals to and from deep-space payloads

Commanding and monitoring space vehicles is the responsibility of "SpaN Net" . . . a global network of radio telescopes set up and operated by Space Technology Laboratories for U.S.A.F.

To fulfill its mission, "SpaN Net" had to meet challenges far beyond the state of the communications art. Never before had powerful command signals and faint telemetered deep-space data been simultaneously handled by a single antenna. How could transmit and receive channels with a differential of more than 200 decibels be isolated? Conventional diplexer technology was not the answer.

Teamwork solved the isolation problem! "SpaN Net" assigned the task to Space Technology Laboratories, Inc., who added DIELECTRIC of Maine to its research, development and production team. Result? An ultra-high-frequency diplexer network that allows the Jodrell Bank radio telescope's single antenna to transmit 20 kw commands and receive 0.002 microvolt signals . . . simultaneously.

This contribution to SpaN Net's break-through is typical of product advances by DIELECTRIC. If you have similar problems in communications . . . from design to delivery . . . it pays to contact DIELECTRIC. Capabilities, facilities and accomplishments are described in our brochure. Write for it today.

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it being 10 to 15 years before the system can become self-supporting seems to render this possibility impractical. The more practical solution at this time appears to be some form of international governmental organization along the lines of, or even a part of, the Organization of American States.

The cost of an adequate telecommunications system is going to be high even if established on a rather austere basis. Just how high depends upon the elaborateness and the degree of reliability decided upon.

How to Finance

Regardless of the cost, it would be far outweighed by the value of the system to the countries of the Western Hemisphere. The practicalities of financing this presents problems of major proportions. The authors are not experts on financial matters. However, there appear to be two methods of financing, one by private investment and the other by governmental investment. The former seems somewhat impractical in view of the large amount involved, lack of assurance of an adequate return within a reasonable period of time and the ever present danger of expropriation and nationalization in some areas.

In the writers' opinion there is no faster way to economic disaster in a country than by the expropriation and nationalization of industry. In a Democracy the very nature of governmental operations practically prohibits the possibility of making a profit or even being self-supporting. The threat of possible government seizure discourages or completely stops private investment and promotes grafting by unscrupulous politicians. Such expropriations become popular and are clammered for by the masses many times largely through agitation by Communists or others for the purpose of causing the downfall of the government.

Since such a telecommunications system would be primarily in the interest of the countries of the Western Hemisphere, not only commercially and culturally but security wise as well, it is almost essential that the financing as well as the control be solely within the Western Hemisphere.

Technical Problems

After attaining reasonable progress in the basic organization and financing, it would be necessary to attack the more technical problems. First, the general routes and the cities to be served must be determined.

The associated map shows a suggested routing and terminal cities. Actual detailed studies may show this to be too ambitious, but these studies are more likely to show that it is not ambitious enough. The routing, capacity and extent of the systems are largely policy determinations of the governing organization based on the financing available and upon the requests and recommendations of the various countries and technical advisors.

There are several studies and surveys which must be made. These must be complete and thorough and be made by independent experts in the various fields. The studies must include, among other things, determination of channels required between each terminal, the method of providing these, and the rates to be charged.

Determining the number of channels requires the weighing of many factors some of which at least border on being "guesstimates." It is extremely difficult to determine the traffic that will flow between two points, particularly, if there has been no means or inadequate means for such traffic before. Surveys are required to endeavor to determine the potential users and the quantity of use by them. How much will be novelty use and how much regular use? How will the estimated traffic be affected by rates? How will it be divided between teleprinter, telephone, aural broadcast, television and other services? How much can the traffic be expected to increase in one year? Five years? Ten years? Twenty years? Answers to all of these and many others must be found as accurately as possible.

Determinations of the classes of services and the channels needed for each are also vital. The installation costs as well as the maintenance costs are very closely related to the class of service. For example: Approximately the same channel and radio frequency space is required to carry one television program as is required for 300 aural broadcast channels, 1,000 telephone channels or 18,000 teleprinter channels. From this it is readily seen that when employing present methods of transmission of television programs, the cost is extremely high as compared to the costs of providing other classes of service. A great deal of work is being done relative to reducing the band width required for television and undoubtedly much will be accomplished in this regard, but there seems to be little hope at this time of making much more than a fifty percent reduction. While this would reduce the cost of television channels very substantially, it would still be very expensive. It may well be that the studies will indicate that television circuits should be very limited at first or postponed entirely for a few years. This is of course a policy matter to be determined from the studies.

Another feature which is very determining in the cost of telecommunications system is the reliability requirements. So far, it has been humanly impossible or at least economically impractical to make mechanical or electrical equipment one hundred percent reliable under all conditions. Just as the most expensive automobile or the most elaborate airplane sometimes fails, so communication equipment sometimes fails. Failure may be the result of mechanical weakness, human error or natural phenomena such as weather conditions. Reliability of obtaining a predetermined minimum performance can be made to approach 100% but 100% cannot be reached. Attainment of 99% is relatively easy. Increasing this to 99.9% is a very major step involving very substantial costs. Increasing reliability beyond 99.9% is increasingly more costly. Since reduced reliability (failure of the system) may be the result of any one of thousands of possible equipment failures, natural phenomena or human errors, to increase the reliability, steps must be taken to reduce the possibility of failure in any of these areas. Equipment failures and adverse effects of natural phenomena may be reduced by the use of better and more powerful equipment, installation of duplicate or even triplicate equipment, employing diversity transmission and reception (this may be space or frequency diversity or a combination), establishment of alternate routes and other devices and methods. Failure due to human errors can be reduced only by employing well trained and experienced personnel under close supervision in the design, installation, operation and maintenance of the system.

The minimum acceptable standards of transmission for the various classes of service also vitally affect the costs and are a major factor in the reliability of the system. The system should provide adequate quality of transmissions (frequency response and distortion) as well as signal-to-noise ratio, but should not be over-designed to where the costs have been increased to provide transmission quality beyond that needed.

Which Techniques of Communications

The methods of interconnecting the countries and cities can be divided into two broad categories—physical cir-

(*Continued on page* 13)

When communications history is made...
Westrex is bound to be on the scene!

El Al Israel Airlines recently announced the first telephone service for passengers on a transatlantic airline.

El Al's revolutionary Skyphone uses Westrex Type 59 Privacy and Westrex Type 58 Privacy

Ultra-compact and rigidly constructed, this transistorized airborne unit offers the ultimate in privacy when sending and receiving radio telephone messages from the air . . . a degree of privacy meeting the most exacting of telephone company standards.

Compact and reliable speech-privacy unit assures the privacy of conversations over point-to-point and ground-to-air radio telephone systems and commercial land-line telephone circuits simultaneously in both directions . . . using the latest in transistorized circuit design.

Investigate the advantages of this privacy equipment for taxicabs, police and fire departments, National Guard units, fishing fleets, and other 2-way stationary or mobile transmission services. *These are just two units from a complete line of outstanding quality products developed and manufactured by Westrex—a pioneer and world-wide leader in terminal communications equipment.*

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Westrex Corporation
A DIVISION OF LITTON INDUSTRIES

cuits and radio circuits. Each of these include a number of sub-divisions. Physical circuits may include open wires, over-head or buried multi-paried cables and over-head or buried coaxial cables. Radio circuits may include low, medium or short wave transmission, microwave and forward-scatter.

Each of the methods has its advantages and disadvantages depending upon what is expected to be accomplished and under what circumstances. It is believed that in the system herein proposed that radio would be found to be the predominate method relied upon, but there may be areas where physical circuits would be more practical. The new cable between the United States and Puerto Rico was mentioned previously. Undoubtedly a great deal of study went into the decision to use cable instead of radio for this particular circuit. It certainly will provide very reliable service during peace times, but the several "accidental" ruptures of the cables to Europe during the past year indicate the ease of sabotage during war time. Physical circuits throughout most of the land areas involved are not considered practical. The very difficult terrain—mountains, jungles and deserts —make both the original installation as well as the maintenance hazardous and expensive. In addition these physical circuits are very susceptible to sabotage and vandalism as well as to natural hazards such as storms, floods, landslides, earthquakes, vegetation growth and falling limbs.

It is believed that a detailed study will show that the use of radio will provide the least expensive and most reliable operation in substantially all of the proposed systems. For technical reasons which it is believed not necessary to discuss here, the radio systems best suited for this are microwave and forward-scatter.

The technique normally referred to as microwave employs radio frequencies ranging approximately from 1,000 megacycles (1,000,000,000 cycles) per second to 10,000 megacycles (10,000,000,000 cycles) per second. Propagation at these frequencies is very similar to that of light and in general is affected by the same factors only to a different degree as would affect the transmission of light; that is, the signals are blocked or materially reduced by mountains, buildings or other opaque obstructions between the transmitter and receiver, and appropriate allowance in power, path length and receiver sensitivities must be made to overcome reduction in normal signal strengths caused by rain, fog, relative humidity and other natural phenomena. This requires that the transmitter and receiver be within "line-of-sight" of each other. Even in so called level country the curvature of the Earth's surface is such that supporting towers are required to raise the antennas to sufficient height to obtain the line-of-sight condition. The greater the distance between the transmitter and the receiver, the higher these towers must be or natural elevations such as mountain tops must be found to minimize the tower requirements. Just as light can be effectively reflected by a mirror, microwave signals can be reflected from a suitable surface. Under certain conditions this permits the avoidance of obstructions which would prohibit communications unless one or more relay stations were installed. Since line-of-sight and other restrictions limit the distance which the transmitter and receiver can be separated to a maximum of approximately 100 miles (the average is between 20 and 30 miles), relay stations will be required. Since these are very expensive, very careful selection of locations must be made in order to keep the number of relay stations to a minimum. Reference to the map shows that some of the over-water paths are considerably in excess of 100 miles so that microwave relaying is not possible in these cases. Even the over-water paths of shorter distances present problems in endeavoring to use microwaves as the sea water provides a very efficient reflecting surface, and the arrival of these reflected signals at the receiver out of phase (and varying phase) causes severe fading and distortion. Adequate measures for the correction are expensive and often impossible. In addition, microwave techniques over some land area paths may not be as practical as other methods because of the inaccessibility of suitable locations, or conditions are such that another method may be more practical and less expensive.

These difficulties may necessitate the use of another radio technique known as forward-scatter which is further broken down into two categories—ionospheric and tropospheric scatter. The former is due to complex phenomena which takes place in the ionized upper atmosphere and the latter due to phenomena (also complex) which takes place in the troposphere or lower atmosphere. Complex as these are, they do provide a means of very satisfactory transmission over distances of several hundred miles which may include either land or water. Such installations require high power and huge antennas, and are, therefore, very expensive, but under certain circumstances are less expensive than other methods of accomplishing the same or equivalent results.

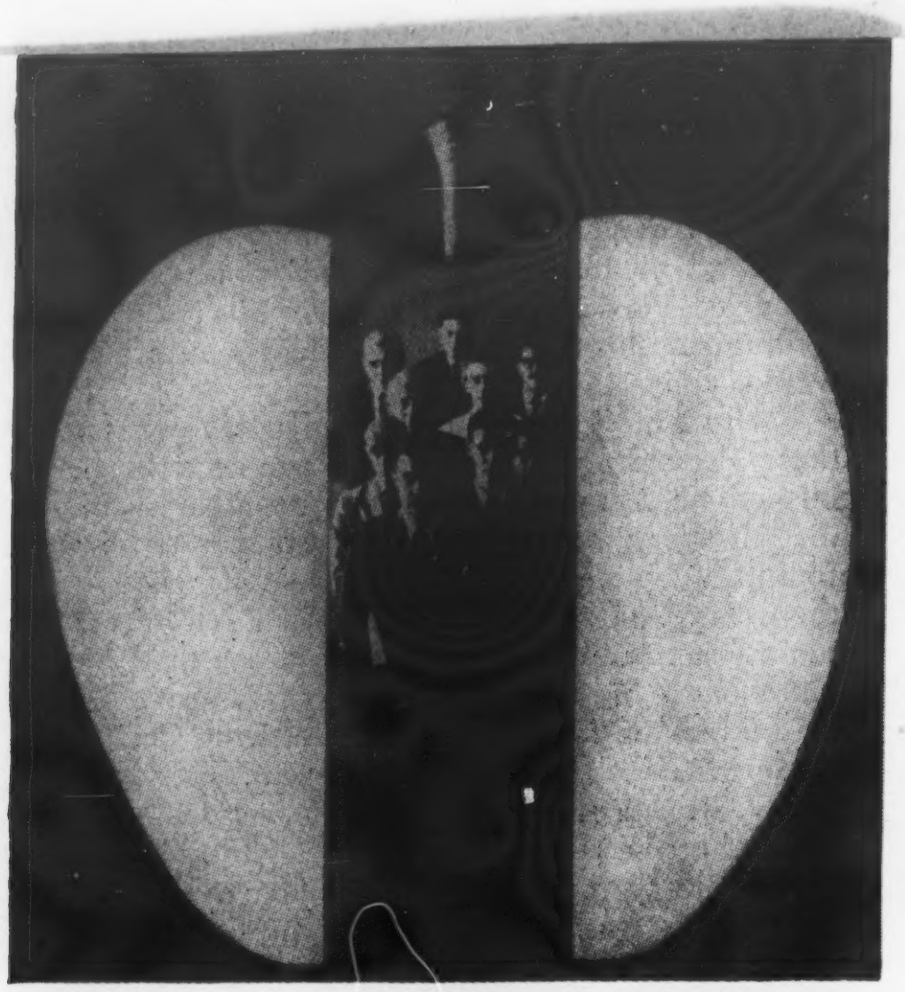
After the preliminary survey has been completed and it has been determined on what routes microwave will be used and on what routes scatter techniques will be used, it will be necessary to make a detailed survey to establish the exact locations of terminal and relay stations. It will then be necessary to determine the detailed requirements for each installation including, exact tower heights, antennas, buildings, access roads, power facilities, security, and other essentials.

Regardless of how carefully the system is planned there will be many locations in remote mountain, jungle or desert areas which will present special and difficult problems. These may require the construction of homes, schools, medical facilities, and churches for the personnel and their families. Qualified people cannot be expected to work, let alone work effectively, unless some semblance of civilized living is provided.

In some locations it may be impractical or too hazardous for families to be accommodated. In such cases rotating crews will be required as well as adequate provisions for their safety and security of the installations. Some locations may be so inaccessible that all material, equipment and personnel will have to be flown in, thus requiring the establishment and maintenance of air-lift facilities including both planes and helicopters.

It would be necessary to establish training schools for the large number of personnel required. Personnel would range from management and engineers through operators, technicians, auditors, bookkeepers, clerks, pilots, truck drivers and numerous other classes. There is presently far from an adequate supply of most of the required classes of personnel. Even adequate instructors for these training schools would present some difficulties. In addition it would be necessary to continue training as expansion of the facilities and normal turn-over of personnel continuously require new recruits.

While some of the major problems have been touched upon, many others will arise, but it can be seen from these and an examination of the map that this is not a small or inexpensive project. On the other hand the results obtained would be more than warranted and the later expense resulting from not providing adequate telecommunication facilities throughout the Western Hemisphere may be greater than can be met.



"CORE CONCEPT"—NEW APPROACH TO SYSTEMS MANAGEMENT AT S-C

A basic problem in Systems Management has grown out of the one-shot nature of each project. In many cases, after the system is delivered, the team dissolves. Then, when a new Systems project is initiated, the process of assembling a Systems team starts all over. This consumes time, effort and money.

We've done something about this at Stromberg-Carlson. We've created a new approach to Systems Management.

We call it the Core Concept.

We've built a *permanent* managerial staff. Because it is permanent, we've been able to bring in top talent in engineering, supervision, research, accounting—men with the ability and experience to handle major projects simultaneously or successively.

POINTS OF DEPARTURE in SYSTEMS MANAGEMENT

And we've also assembled a group of prime capability sub-contractor companies—*in advance of systems proposals*. As a result, we are able to get projects off the ground faster, to carry them to successful completion with a minimum of lost time or effort—*at a lower cost to Government*.

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As a leader in electronics and communications, we're qualified to take over additional systems management responsibilities in undersea or CBR warfare, command control systems, and related areas.

Why not let our Systems Management people show you how Stromberg-Carlson's "Core Concept" can be put to work on your program?

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A DIVISION OF **GENERAL DYNAMICS**
1400 N. GOODMAN STREET/ROCHESTER 3, N. Y.

THIS BREADBOARD IS LEARNING TO TALK... AND LEARNING FAST

No, it's not an exotic loudspeaker or other transducer we're aiming for in research at Stromberg-Carlson. It's an electronic device that can turn a coded signal into actual speech. Why?

Well, by encoding your voice for transmission along a channel many magnitudes narrower than that occupied by the original speech sound wave... and by synthesizing this signal back into speech at the other end... we can cram many messages into a given circuit capability, frequency range or bandwidth.

This program demands probing beneath classical phonetics into the very psychological and physiological mechanisms of human communication. It requires mathematical analysis of speech patterns, and it calls for new computer logic.

in COMMUNICATIONS RESEARCH

Already, this research program is well advanced. This year we should complete analysis equipment and partial analysis of speech signals.

A machine that speaks is only one of Stromberg-Carlson's current objectives in research. A random sampling might spotlight such projects as these: Studying and evaluating solid-state materials and devices to meet the requirements of specific radio frequencies. Adding to our basic knowledge of data transmission in order to increase speed and reliability, at lower costs. Enhancing our knowledge of thin magnetic or dielectric films and their application to high-speed access storage systems. Tailoring solid-state molecules into super-sophisticated circuits or circuits not previously possible. In short—we're interested in anything that will lead to a better understanding of electronics and communications—terrestrial, maritime, or celestial.

HOW TO ELIMINATE 99 OF EVERY 100 MINUTES IN SYSTEMS TESTING

SCATE—Stromberg-Carlson Automatic Test Equipment—is just what the weapons system engineer ordered. It is very likely the most advanced, and fastest test equipment available today.

Programmed with punched Mylar tape, SCATE tests an unprecedented number of parameters, makes marginal and contour tests, isolates specific faults, detects performance degradation, predicts probable sources of failure, continuously checks itself, displays a rapid HI-GO-LO and numerical evaluation for each test and prints a permanent record... all in record-breaking time.

SCATE pays off in flexibility and economy, too. Standard building-blocks—solid-state modules using proven, reliable circuits—form the nucleus of the

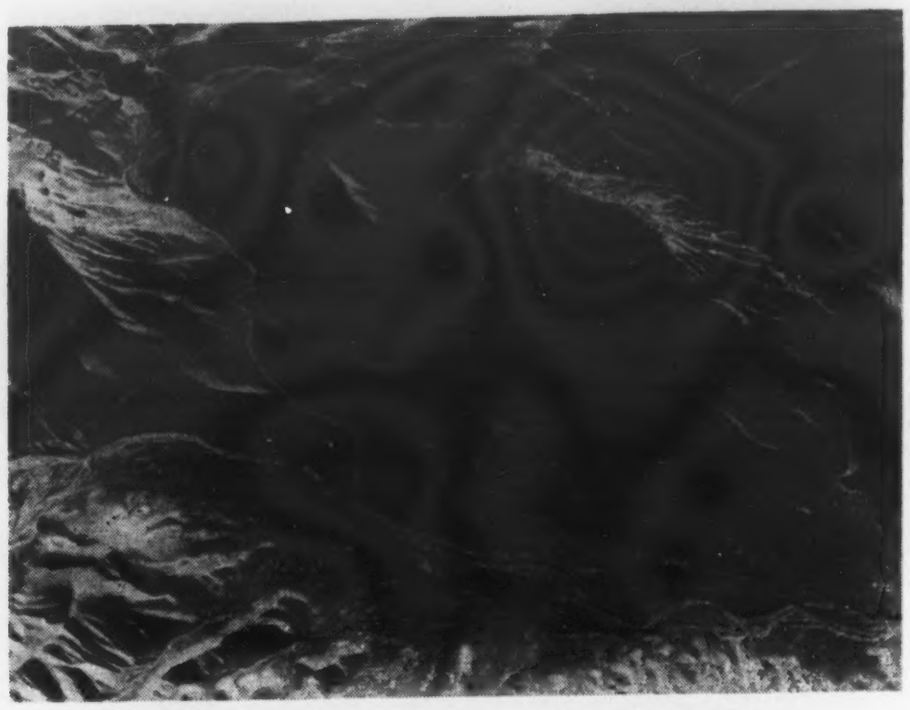
in ELECTRONIC EQUIPMENT

basic SCATE system. Unique blocks—special stimulus generators and response normalizers—custom-tailor SCATE to the particular test requirements of any missile, aircraft or ground electronic system. And that old bugbear of test equipment—development changes in weapons systems—is no problem at all. Substitution of certain modules keeps SCATE up-to-the-minute, matching any weapons system from prototype to operational status.

Speed? 7000 bits per second. Recently, in a classified area, SCATE reduced a 12-hour manual testing program to less than 5 minutes. This represents a time reduction of over 99%.

In sum, SCATE is the only automatic test equipment that delivers these four critical advantages: (1) fault isolation, (2) self-testing, (3) complete solid-state modularization and (4) in-development flexibility. Descriptive literature on request.

Aerial view of the Kermanshah Valley of Iran.



Erosion in the desert mountains of western Pakistan.

COMMUNICATION PATH DESIGN BY RADAR

GIVEN AN AIRPLANE flying at a known altitude, plus a downward focused radar which could accurately measure the distance between the plane and ground, it would appear to require only a simple arithmetic computation to determine the elevation of the terrain beneath.

So says theory!

But, taking this same laboratory concept and adding the problems of airplane speed and drift, operation under extreme ambients, logistic support of over 12,000 miles, and it becomes obvious that the technique is not as simple as it first appears.

This important method of terrain profiling is, however, being practiced by Television Associates, Inc., of Michigan City, Indiana. The method was first conceived shortly after World War II when, with salvaged military airplanes and radar equipment, this Company both demonstrated its theory and, on the basis of the data collected, built one of the first television microwave networks in the United States. Since then, well over 15,000 path miles of television, pipeline, toll road, and military communication networks have been surveyed by this method.

Currently, Television Associates, Inc., is acting as prime contractor for the survey and design of two of the largest communications systems in the world—that bridging Turkey, Iran, and Pakistan, and the equally strategic Southeast Asia system of Thailand, Laos and Vietnam.

Circuit wise, there have been many improvements over the original crude instrumentation that sufficed to survey the original Chicago-South Bend system. Visual observation and recording of instruments first gave way to photographic methods; photography was then replaced by instant display recorders and the laborious hand processing of data replaced by electronic computer systems to bring about the instantaneous all electronic equipment now in use today.

While the completely packaged system of today is a far cry in outward appearance from the "black box" of 1945, the basic theory of operation remains unchanged.

System Operation

The key to the operation lies in the linear radar system which, through FM circuitry, continually probes the distance separation between the airplane and the ground beneath and instantly interprets this distance in terms of a DC voltage which varies in accordance with the measured distance.

The altitude of the airplane in which this radar is mounted is measured by a specialized strain gauge (borrowed from missile technology) which similarly translates the altitude of the observing plane into a DC voltage of opposite polarity to that supplied by the radar.

The combination of these two opposed voltages superimposed on each other, produces a resultant DC voltage which represents the actual height above sea level of the section of ground directly beneath the observing plane. This voltage, applied to the input of a strip recorder, instantaneously produces a graphic chart of the elevations along the path.

Because the radar probing beam is conical, the amount of ground explored varies with the altitude of the airplane above the terrain. For this reason it is necessary, in flying microwave paths, to keep the airplane as close to the ground as possible in order that the radar will integrate and record only the smallest possible area. This requirement can be met by flying at elevations of 100 to 400 ft. above the ground during measurement runs, a feature of this type of surveying that presents many problems in airmanship.

Aerial Survey Experiences

While the technical aspects of the equipment are of interest, the actual experiences of this group in carrying out these low altitude surveys on a world-wide basis, is indeed fascinating.

Flying at tree top level requires considerable skill on the part of the survey crew. Besides having the visibility ahead reduced to a minimum, the airplane itself is, at times, exposed to close range attack by moonshiners, guerrillas, deer hunters, and irate farmers. One of the earlier surveys in the Ozark Mountain territory apparently interrupted a major bootleg operation based on the return fire experienced. A subsequent survey in the Sierra Maestra mountains of Cuba, while Castro was mounting his campaign, added machetes, cane knives and shotgun blasts to the ground return.

In many cases, the survey path planning will require low level flights over inhabited areas. Because of the possibility that the unexpected appearance of the plane may stampede stock, turkeys, and other domesticated animals, a high level reconnaissance flight is generally conducted to spot these possible problem areas. Even this precaution, however, did not prevent our survey plane from inadvertently starting a stampede of circus elephants deep in the heart of Kansas.

Another interesting, but "non-habit forming" practice in this aerial survey work is the measurement of tree height by radar. The theory again is straight forward—fly the plane into the topmost branches and take a radar reading of height. While again no one can dispute the theory, in practice this technique has sometimes resulted in an unexpected harvest of hearts of palms, or a dented airplane. In the Middle East and Southeast Asia areas, the problems of moonshiners and trees give way to high mountain passes and unfriendly deserts, that permit no second guesses.

In spite of the problems, many thousands of miles of path surveys have been completed with none but minor incidents to date, if one can disregard the crash of one plane on the Turkish-Iranian-Russian border.

Advantages of System

It is this ability to put airborne measurement equipment into an area where access to a ground survey team is either refused or impossible, that makes this technique both interesting and important. A further important advantage of this new technique lies in the speed and accuracy with which terrain data can be collected and translated into usable graphs. At normal flight speeds of 120 miles an hour a detailed graphic analysis of the terrain elevation can be immediately created. This is a far cry from the slow progress of the very best ground based survey group equipped with rod and chain.

Further, the ability of the observation plane to fly a straight course between terminals, independent of the ground conditions, gives the airborne method many advantages over the ground crews who might circumnavigate or abort in swamps, mountain passes or dense jungles.

Even though the practice of this type of electronic survey can be considered somewhat marginal from a safety concept, the safety record of Television Associates, Inc., in carrying on this work has been outstanding.

To date, these techniques have been employed primarily in establishment of terrain profiles for communication systems, but the application of this technique to other areas of survey has not been disregarded. An obvious and important new application of this Radar Terrain Profiling method would lie in the airborne surveillance of beach heads by installation of the apparatus in drones or remote controlled aircraft. A further use would appear to lie in early reconnaissance studies of road and railroad routings, or in fact, any application where immediate profile data might be required.

In summation, it would appear that the development and practice of this all-electronic airborne method of ground measurement is an important and far reaching step forward from the "wagon spoke" surveys of our forefathers.

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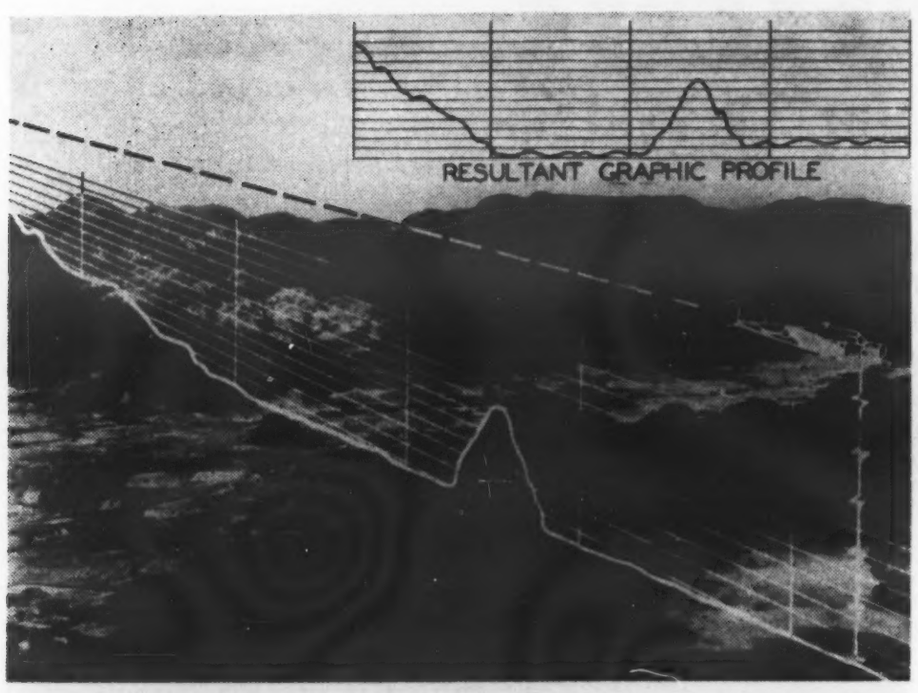
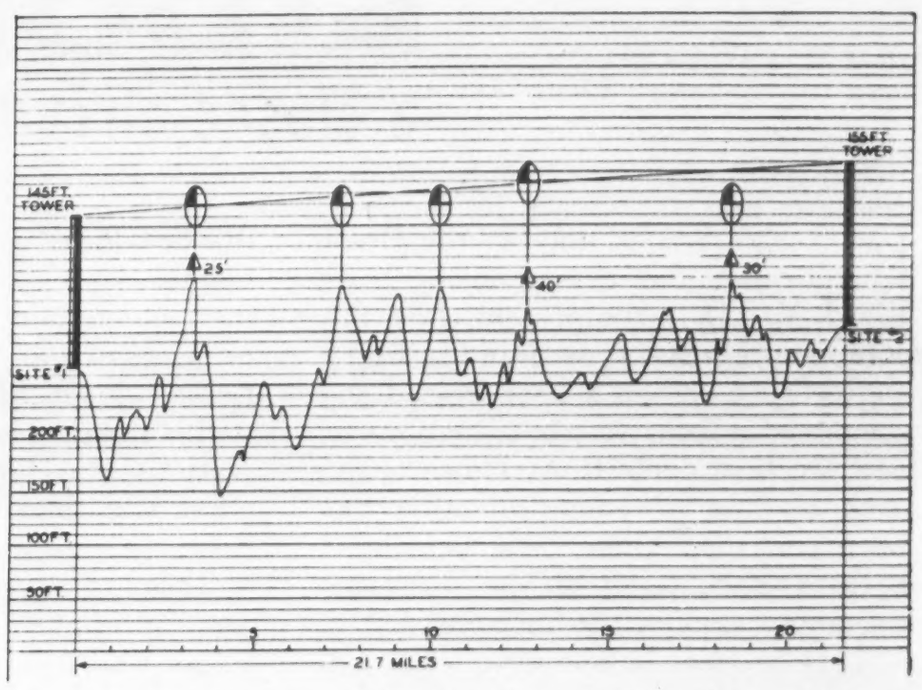
by CAPTAIN W. C. EDDY, USN (Ret.)

President, Television Associates, Inc., Television Associates of Indiana, Inc.



A graphic explanation of the Radar Profile Technique with its resultant graph.



Conformed profile report indicating terrain variation, tree heights on ridges and computed tower heights.

In the picture at right, the author (left), President of Eidophor, Inc., and Felton Davis, Jr., Vice-President of Eidophor, Inc., with projector. (Below) Korean War commander General James A. Van Fleet receives ovation at dinner for outstanding personalities in American life, sponsored by Research Institute of America. Large Eidophor screen is in background.

by RODERICK L. O'CONNOR, President, Eidophor, Inc.

EIDOPHOR

a closed-circuit color TV system

IN RECENT YEARS, notably the years following the commencement of Word War II to the present time, the combined efforts of civil and military engineering research have raised the science of military communications to new levels of perfection. However, as each method of communication has been perfected, there have developed new methods to challenge the engineers and expand the horizons.

This process is not new. The science of military communications has a long history. Primitive peoples in the pre-dawn of recorded time hammered crude messages on drums as they concerned themselves with the business of war. Then, a more sophisticated form of signal was devised with smoke. The great classical civilizations developed the post horse, what was then an efficient means of communication that spanned empires.

These methods of communication were ultimately replaced by the semaphor and finally the wireless as man came to realize his acute need for swift communications. A new horizon in communications was founded upon exciting discoveries made in the field of electronics.

Now, the advent of audio-visual communications through large-screen, closed-circuit television offers a new measure of progress for military communications. The need for its use in this vital area already has become strikingly apparent. Some work on these developments has already been done. Much more remains to be done.

At Eidophor, Inc., we have given much thought to the uses of large-

screen television in military operations. The Eidophor* television system, with its unique "control layer" projector, is equipped to play a major role in military communications. Invented in the laboratories of the Zurich Polytechnical Institute, the Eidophor projector was developed over a number of years with the aid of CIBA, the international chemicals, plastics and pharmaceuticals firm. It is the only television projector that uses an independent, high-intensity light source to generate projection light. This independent source of light makes possible the projection of brighter and clearer pictures than have hitherto been available.

Eidophor is able to project black and white or color images onto a large screen with near motion picture clarity. This is achieved through a patented "control layer" process by which light from an outside source is beamed onto a spherical mirror coated with a film of chemically-prepared oil .1mm in thickness. The mirror is bombarded with electronic impulses from the cameras; these impulses create "wrinkles" on the oil film surface which reflects image-bearing light through an objective lens and onto a large screen. Color telecasts utilize the sequential system and project an image of up to 24 x 18 ft.

Eidophor, Inc., maintains the largest and most completely equipped color mobile television unit at its New York demonstration center. In addition to serving as a control room for color telecasts, the mobile unit is a storage van for an entire Eidophor closed-circuit projection system. Long in development, this mobile unit contains, in addition to two Eidophor color projectors, microwave relay equipment, four complete sequential color camera chains, complete control equipment and a variety of studio and theatre equipment including two large projection screens. Because it was designed to operate anywhere in the country—even under adverse field conditions—the Eidophor mobile unit is a most important development in communications wtih specific military applications.

Mass Military Instruction

Television generates interest because it is *live*, it is immediate. Hence, it is a stimulating and most effective factor in the mass instruction of military personnel.

Of course, a primary function of large-screen closed-circuit television for the military will be in the areas of fixed and field training, especially training of a technical or complex nature. Our military organizations maintain schools which graduate thousands of highly-qualified technicians annually. In fact, the military operates the largest single school system in the world. The use of large-screen television in these schools will help immeasurably to increase student interest. It will, at the same time, enable the military to mass instruct highly specialized fighting men via methods that will save tremendous sums of money in terms of time and personnel.

If, for example, a class is to be conducted in the complicated circuitry of a radar or computing device, a single instructor may teach a thousand students in a single class. Previous to the use of large-screen television, instructing a group of such proportion entailed the use of many instructors, multiple classrooms and an impressive array of audio-visual equipment. By using a "follow-the-leader" instruction technique, developed by industry using closed-circuit television, each student may repeat and perform, step-by-step, the directions of his instructor. This follow-the-leader method of instruction through large-screen television may be used in a variety of military training situations.

With the remarkable success of Eidophor large-screen color projection of high resolution and clarity, even the most detailed type of technical instruction can be achieved. Often, the use of color is required in such detailed technical instruction as, for example, color coding in complex circuitry of electronic equipment.

There are a variety of ways in which large-screen closed-circuit television can be used to great advantage in training programs for the military organization. For example, the brilliantly-illuminated screen can convey mass instruction on weapons assembly and disassembly. Huge classes in map reading will be made possible through the use of color projection, which will show roads, streams, towns and terrain contours with exact color fidelity. Large classes in hygiene and first aid, aircraft, ship or vehicle maintenance, military procedures and indoctrination are other classroom uses of large-screen television. For example, a class in fire control may be visually taught to a virtually unlimited number of men simultaneously. Seated in auditoriums in different locations around a large base, these men would be shown methods of combating fires, which, for training purposes, could be picked up by remote cameras at four or five points and flashed instantly to a screen in each auditorium. Such classes would be recorded on video tape and shown to an equally large group later that day.

Flight Simulators

Experiments are in course now for Eidophor use with flight simulators to create visual stimuli for on-the-ground pilot training. A television camera linked to the controls of a flight simulator duplicates the flight patterns over a scale replica of an airfield. As maneuvers are negotiated by the pilot-trainee, the camera correlates his progress, via projector, on the large-screen before him. From the pilot's seat a remarkably realistic view is achieved of the trainee's entire landing from the moment he achieves visual contact with the ground until the wheels of his plane hit the runway.

Such simulators, when in wide use, will permit savings amounting to millions of dollars normally expended for aircraft maintenance, fuel and instructor personnel. Moreover, the advantage of such a system is not limited to the one trainee in the pilot's seat. On another screen in a classroom, many more trainees can profit by observing such simulated landings and listening to a running critique supplied by the instructor.

Naval aviation will make advantageous use of the visual flight simulators in the indoctrination of pilots to carrier landings. Large-screen projection will provide visual reference in the approach to the carrier deck; the pilot-trainee will estimate his aircraft's attitude by watching a simulated mirror-light system shown on the screen. The employment of color projection would be paramount to this specialized type of flying training. Visual flight simulators will provide maximum safety for student pilots testing newly-acquired skills, and large-screen color clarity will serve to enhance the realism needed for simulated flight.

A range of simulators, akin to the visual flight simulators, are planned for research and development. Notably, these would be in areas concerned with vehicular training and ship command, or helmsmanship. The same training applications as those for visual flight simulators will be valid.

Data Display

Still another area of military interest in which large-screen television may be used to great avail is in the field of data display for intelligence

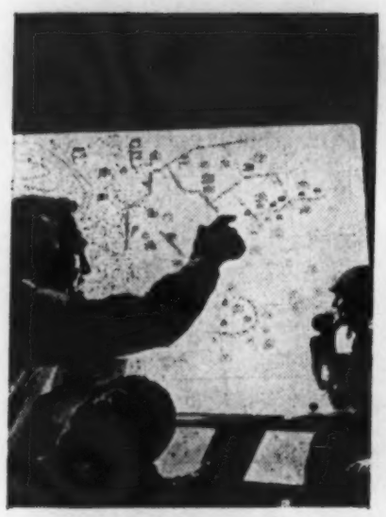
(*Continued on page* 21)

*Registered trademark

ARTOC

THE COMMANDER'S ELECTRONIC ASSISTANT

ARTOC...the Army Tactical Operations Center
...mobile electronic command post geared to
the stepped-up pace of tomorrow's battleground.
ARTOC...a synthesis of the newest techniques
in communications, electronics and data processing
...gives the field commander a comprehensive,
up-to-the-minute visual display of the battle situation
...helps him make the right decision at the right time.



ARTOC... is being developed by Aeronutronic Division of Ford Motor Company for the U. S. Army Signal Corps. It is one of many Aeronutronic programs aimed at simplifying military and industrial problems through the use of an advanced computer and data processing technology. These programs—and many others related to advanced weapon and space systems—are underway at Aeronutronic's Engineering and Research Center, in Newport Beach, California. They demonstrate Ford Motor Company's rapidly-growing capability in meeting the needs of science and defense in the changing world.

A booklet describing Aeronutronic's accomplishments and capabilities is available to you on request.

AERONUTRONIC

AERONUTRONIC DIVISION *Ford Motor Company*, DEFENSE PRODUCTS GROUP

Ford Road, Newport Beach, California

WEAPON AND SPACE SYSTEMS • COMPUTERS AND DATA PROCESSING SYSTEMS
MISSILE RANGE SYSTEMS AND INSTRUMENTATION • ADVANCED ELECTRONICS
Career opportunities are open for engineers and scientists

Eidophor

(*Continued from page* 19)

or command purposes. Today, the complexity of military intelligence data often requires electronic computation. Such data must be made available to groups of men in whose hands the power of immediate decision and command are entrusted. To give an example; when a missile is tracked, bulk information is fed into computers and consigned to tape. If a group of observers are to view and assay the value of this information at once, data may be imaged onto the screen directly from the computers through the use of an ancillary translating device linked to the projector which will transform electronic impulses directly into numerical images. Thus, in effect, the large-screen serves as a sentinal device to aid the swift process of decision, command and execution. Data display systems utilizing large-screen closed-circuit television projection may be used in a variety of military computing situations.

Closed-circuit television can serve to great effect the briefing of officers and troops about to partake in extended field problems. By this means problems of close coordination can be more effectively solved. Commanding officers will be able to address whole corps of troops at once; a general may brief an entire division through use of a chain of large screens set up at various points in the division area.

Public Relations

Another area in which closed-circuit television will aid the total military effort is in the ubiquitous field of public relations. Frequently, military organizations will host demonstrations for civilian officials; these demonstrations run the gamut from firepower demonstrations, weaponry meets to extensive field problems. Flexible large-screen television can create goodwill among visitors invited to witness military events. It may allow them to see many important activities that could not be shown previous to the use of large-screen television.

The uses of closed-circuit television in military operations would appear to be almost limitless. We at Eidophor discover possible new applications of our system for this purpose with each passing month and try to equate these ideas in terms of substantial progress. Large-screen closed-circuit television, beyond doubt, is destined to play an increasingly important role in the nation's defense.

COMPUTENCE

TOTAL COMPETENCE IN COMPUTATION AND DATA PROCESSING—THE BREADTH, THE BRAINS AND THE BACKGROUND

For instance, ALRI: USAF Airborne Long Range Input Program, one more demonstration of Computence—and Burroughs Corporation—throughout the contract team program. **The objective:** a seaward, airborne extension of SAGE via radar-equipped reconnaissance aircraft, processing data in flight and transmitting it through ground receiving sites to central direction centers. **Total competence:** the way Burroughs Corporation, as System Manager, directs the integration of the special skills and facilities of its team*. **Total computence:** the way Burroughs Corporation, also a team member, develops ALRI's miniaturized airborne data processors—reflections of its breadth (R & D through field service), brains (such as the Atlas guidance computers, data processing for Polaris) and background (75 years devoted to computation and data processing).

*Lockheed Aircraft Service, Inc.●Packard Bell Electronics Corporation●Philco Corporation●Military Electronic Computer Division of Burroughs Corporation●Electronic Communications, Inc.●GPL Division of General Precision, Inc. and●AC Spark Plug Division of General Motors Corporation.

Burroughs Corporation

"NEW DIMENSIONS / in computation for military systems"

the present crossroads in global communications

by MAJOR GENERAL EARLE F. COOK, USA
Deputy Chief Signal Officer

ON THIS OCCASION marking the 4th National Symposium on Global Communications, the Signal Corps has assisted in this meeting as a part of the activities marking its Centennial Year. The Symposium committee has been generous in recognizing this 100th Anniversary of the Signal Corps by giving the platform to one of that Corps. Let us now consider the broader aspects of things. Many people and many agencies are involved in this field of communications that so preoccupies our minds. Global communications is not a theoretical possibility—it is a practical problem with vast commercial and military importance. Global communications is a product of technical and economic development in the world—it is a necessity in our day and age.

Future Course

Many of us who are concerned with planning for the future see limitations in our present technology which is being stressed to meet growing demands. The need for expansion of global communications faces the developer of equipment, the manufacturer, the frequency planner, the operator and, of great importance, the stockholder and the tax-payer. In what direction *is* the future of global communications? What course should development take for effectiveness and economy? Along what path is the solution of international problems in global communications? There are numerous possible answers to each of these and other pertinent questions, and advocates of each of them. I see us now as having come to our present position along a road of unparalleled progress in discovery and invention—most of it in the past thirty years—and I see us as finding ourselves now at a crossroads where major decisions must be made. We must read the signposts, we must make a reconnaissance along each of our possible choices, we must confer and debate, and we must make the right decisions.

There is an ingredient that is essential if the right decision is to be made, and that is men—and women—who know their business. I have no doubt that this nation has such people. If a problem exists in this respect, it is one of selecting the best person for a given problem, and of organizing all of them for effective teamwork. It's strange how difficult this can be. With the knowledge and the teamwork, the decision as to what to do can be made with great assurance.

Old Principles, New Products

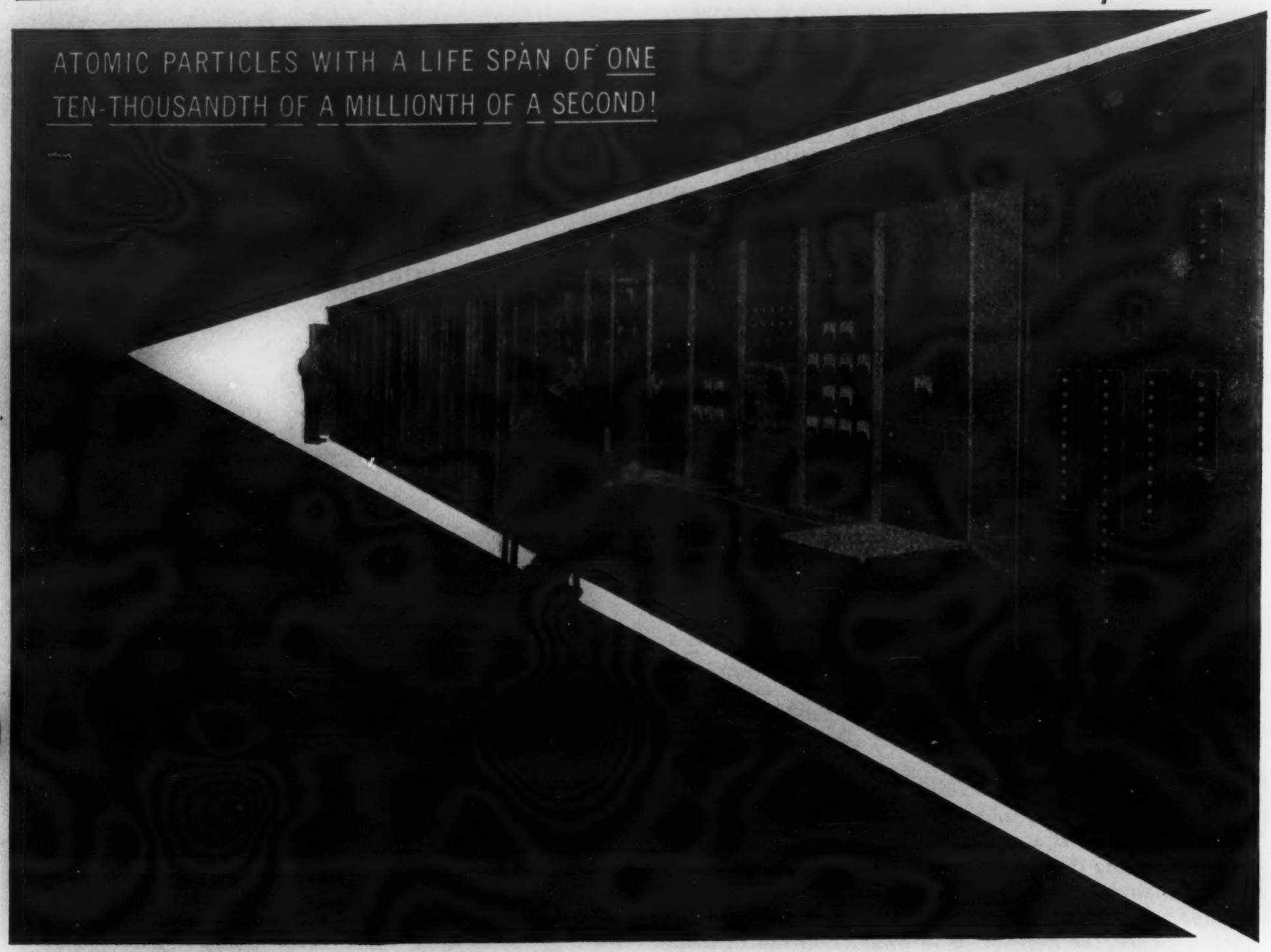
I said that we had come to our present position along a road of unparalleled progress. Where did it start? If we consider that we are talking about electrical communications, we can pass over the time when man used horns to help his own voice carry farther, when he sent a messenger to repeat his words or carry a physical thing that bore his markings, and when he produced signs or symbols that could be read from a distance. Actually all of these means of communications continue to exist today. The cheer-leader and the boatswain use megaphones. All of us use the mails. And traffic signs and lights are certainly means of communication that make it unnecessary for a police officer personally to communicate the same meanings. Examples of modern adaptations of these primitive forms of communication could be cited at length, and new devices are constantly being produced that use the same principles. None of them, however, except the mails, can claim any utility for global communications.

It was not until the invention of the electrical telegraph and the demonstration of its practicability in the first half of the 19th century that instant communication between places separated by many miles could be provided. The service of the telegraph in the development of the western portions of our nation has seldom been appreciated in modern times.

The submarine cable was an outgrowth of the land telegraph. Do many people today remember what a great economic venture it was to lay the first submarine cable between the United States and Europe in the middle of the 19th century? A special steam-ship, the Great Eastern, had to be especially fitted to carry some 2300 miles of cable, and several trials over a period of about ten years were necessary before a successful cable was laid. That under-water adventure can be likened to the efforts in space today and our work in the United States towards using earth satellites for communications purposes. We need the same confidence in this satellite work that the

(*Continued on page* 25)

space age research



Continental Electronics, specialist in super power electronics equipment, is building the radio frequency driver system for the linear accelerator injector for the proton synchrotron now under construction for the Argonne National Laboratory. This driver system will have a peak power of 5 megawatts, with an average power of 25 kilowatts, operating at a frequency of 200 megacycles with a 500 micro-second pulse.

When completed, the Argonne proton synchrotron will accelerate protons to an energy of 12.5 billion electron volts, enabling scientists conducting atomic research to experiment with known phenomena and discover new phenomena that occur when protons of high energy collide with other protons at rest. This collision usually results in the production of rare, short-lived particles; some with a life span of one ten-thousandth of a millionth of a second!

To achieve the high energy required to produce these rare atomic phenomena, protons from a conventional ion source are first accelerated to 750,000 electron volts with a conventional high voltage supply. They are then increased to 50 million electron volts by passing through the linear accelerator, reaching final energy of 12.5 billion electron volts in the synchrotron.

Continental Electronics is proud to be a contributor to the Argonne National Laboratory's atomic research program which is dedicated to increasing scientific understanding of atomic energy.

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proponents of the submarine cable showed.

The telephone is also along this road we have come. Depending upon your disposition when the telephone in your home or office rings, you bless or otherwise comment on this instrument of communications. More and more it is becoming an instrument of global communications. I need not tell you or remind you that the telephone is indispensable in modern business and private life.

Then about the turn of the 20th century came the wireless, the radio. In electrical communications, I would say that the introduction of radio made a fork in the road of progress I have been talking about. Both types of systems, wired and wireless, found their place in communications and developed to world-wide usefulness. But generally they developed as separate systems, along different roads not too far apart. Radio was the junior, and by its very nature was beset with many problems that the wire telegraph and telephone never had to face. Radio has come to be rather well understood only within our lifetime. I say "relatively well" advisedly because sometimes it is necessary to remind ourselves that the wonderful thing about radio is that it works at all. Some people can't understand why it doesn't work sometimes, such as over a range of about 100 miles with equipment that a man can tote on his back.

In about the last fifteen years, these two roads of essentially wired and essentially wireless systems have come together and our treatment of the field of global communications includes the technology found in both fields. Also, in the past few years, we have the very challenging subject of communication satellites presented to us for consideration of its place in global communications. All of these developments along the road back, therefore, appear to be grouped in a total technology and applied to the problem of global communications. We look to the future. We are at a crossroads in global communications.

Sign Posts in Global Communications

What do we find at this crossroads? Here, there are figures on the world population and estimates of its growth. Here, there are very large investments by commerce and government in existing global systems for serving the present population. Here, there are communication satellite developments, projected to provide a staggering increase in our capabilities for global communications. Here, there is an already great and expanding national competence for scientific advances. Here, there are problems of international cooperation for efficient use and conservation of that gem among natural resources, the radio frequency spectrum, which is a natural resource uniquely available to all nations, like the air we breathe. Here, there is the formidable question of the wherewithal to accomplish what needs to be done. Here, there is the problem of organization and teamwork to plan, to provide, to operate and to service the communications that will be needed around this globe we call Earth. It is as though we stand at a real crossroads, with libraries of knowledge around us, a throng of people qualified to use that knowledge, a bank on the corner and road map that shows only where we have been. It is up to each of us there, each of us to our best ability and according to our position, to do his part in making and carrying out the decision as to which course to take for the best in global communications for the future.

Although our road map is no help to us, are we completely without signs? There *are* signposts at this crossroads which point to research and investigations. This is the trailblazing work that is carried out by those gifted individuals who think ahead of us who have more practical problems. A signpost here points to great work done on information theory. Another there points to studies on orbiting vehicles, their environment and their behavior. Another signpost yonder points to studies on data generation and processing. Another indicates radio propagation research in progress. And so on. The reports that come back from these pioneers in the technical realm will add to our knowledge. Those who work in the unmapped areas of the sciences that we need to explore must also participate in the decisions to be made. And we must not forget that they need the tools and instruments of their craft and the normal human support they deserve while they are out there in the research area, "prospecting," if you will, seeking the mother lode in the goldmine of science, for our use in global communications.

Meanwhile, back at the crossroads, all is not quiet. A number of possible roads into the future are being charted. Organization and teamwork are being developed. Interchange of information is constantly increasing. Factors that affect international problems are being explored. There is a general awareness of the magnitude of the problems of the future and a restless stirring to be up and at them. The spirit, I think, is somewhat akin to that which must have prevailed when a wagon train was being assembled in Kansas to begin the journey across the unmapped west less than a century ago. These people had different trades and crafts, they carried with them their personal belongings and maintained their individuality, and yet by their teamwork and energy they achieved their goal.

It is not my purpose to try to outline what I think the future course of our national effort should be in the field of global communications, whether I expressed what could be taken as a Signal Corps viewpoint or whether I spoke as an individual. I have attempted to look at global communications generally, in perspective and objectively, as one with a very great personal interest in the subject. It is not a field of military interest only, as I tried to make clear earlier. And, therefore, as I have treated the subject, it is not one that the military alone have to consider. Teamwork in their separate endeavors, however, is bound to be of benefit to both the military and the commercial communications and electronics industry.

Understanding Through Communications

Does anyone question why global communications merits such importance as is placed upon it? It is well to remind ourselves that aside from the business incentive and the military necessity for global communications, there is the great service to peace throughout the world that facilities for global communications provide. Communication between people is a natural desire which fosters understanding. Understanding leads to acceptance of views or resolution of differences. All of us know these truths from our personal experiences. International commerce is expanding, travel of people from nation to nation is increasing with progress in transportation, new nations are being formed, each with their independence and particular customs and practices, and the entertainment and instruction that radio broadcasting and television can provide are now available world-wide on a limited scale only, Communications necessary in connection with each of these endeavors develops not only a mutual understanding on the subject of discussion but also, in many cases, a personal friendship that leads to closer understanding between peoples.

Let us keep in mind at this present crossroads in global communications that mutual understanding is a way to peace.

The mission of the new USAF organizational complex at Hanscom Field is to provide the ground electronics environment for command and control of all aerospace vehicles. The Command and Control Development Division of the Air Research and Development Command plans, programs and manages the development and test of command and control sys-

amc electronic systems center

by MAJOR GENERAL CLYDE H. MITCHELL, USAF, Commander, Electronic Systems Center, Air Materiel Command, Laurence G. Hanscom Field

ONE CANNOT FIND out how to perform miracles in a history book.

The collective mission of the new Air Force organizational complex at Hanscom Field is to manage miracles.

Or to put it another way: it isn't so much an unprecedented job as it is a job without precedent.

There is an old saying that the scientists of each new generation see further than their predecessors because they stand on the shoulders of all prior generations in an ever-mounting pyramid. Historically, I think, this statement has been true—until this generation. But scientific progress has been so rapid in this generation that it has reached escape velocity. For reasons not quite clear to any of us, I feel, the genius of this generation has freed itself from the gravity of evolution. The rule for travel in the unknown is: go light, leave the history book at home, and prepare to perform miracles.

I'm sure the scientists of Air Research and Development Command who are responsible for the design of our modern communications and electronic systems often feel that they are being asked to "perform miracles"—and usually with a "not later than . . ." clause thrown in for good measure.

I assure you that we in Air Materiel Command (AMC) often feel the same way when the ARDC-type scientist turns to us and says: "Okay, here's the design; now build it."

Actually, I speak seriously when I say we are being asked to manage miracles. Our collective mission at the Hanscom complex is to design and deliver a total ground electronic environment of such a nature that we can adequately command and control all aerospace vehicles.

We have learned the hard way that it is absolutely essential that AMC begin its planning for the procurement, production and logistical support of an electronic system from the very inception of that system. We have traditionally received the "now get it built" order long after the operational requirement for the new weapon system has been established and even after the initiation of system design. With an organizational structure, such as ours at Hanscom, it will be possible for the first time to truly integrate the planning of *all* commands from the very outset. We just do not have the time in the electronic systems business for planning in sequence.

Corollary to the advantage of properly concerted and time-phased planning is the additional advantage of being able to plan and think *above* the system's level: we will be able to plan and think at the level of the total ground electronic environment. Collectively we will be in a position of perspective. Now, this means at both the design and procurement stages we can be on the lookout for the possibility of a particular piece of equipment being utilized in more than one system, and we will also be able to insure inter-system compatibility.

In regard to the mission, organizational structure, and operational philosophy of AMC's Electronic Systems Center, our mission has been expressed as: "The acquisition and delivery of communications and electronic systems and to manage operational activities pertinent to procurement, production, installation, maintenance, and supply functions during the development, testing, and acquisition phases of communications-electronic programs. Back to that "managing of miracles" bit again.

The first point I want to emphasize about our mission—and this is applicable to the entire Hanscom complex is that we deal in *complete* systems. We are not AMC's agency for the procurement of individual electronic equipments or components. That has been and is now the responsibility of the Rome Air Materiel Area (more on our relationship with ROAMA later).

Second, the Electronic Systems Center joins AMC's Aeronautical Systems Center and Ballistic Missiles Center as an organization authorized to report directly to Headquarters AMC and to call upon the support of other AMC agencies.

The Commander ESC has a small special staff and a functional staff consisting of Directorates of Systems Integration, Logistics, and Procurement and Production. In addition we have liaison representation from the Office of Civil Engineering, Headquarters USAF. These three directorates perform their services for all thirteen systems. Let me comment briefly on two of the offices within these directorates to tie in with my earlier remarks about some of the advantages of the Hanscom complex. The Advanced Systems Division is specifically charged with initiating AMC advanced planning in regard to those electronic systems that are still at the study stage and for which there has not, as yet, been established a special project office. This planning insures that AMC procedures are set into motion in sufficient time to eliminate the possibility of our turning up too late with too little. This planning

(*Continued on page* 31)

tems at Hanscom. Purpose of Air Materiel Command's Electronic Systems Center in the Hanscom mission is to acquire and deliver communications and electronics systems and to manage operational activities pertinent to procurement, production, installation, maintenance and supply functions of communications-electronics programs.

command and control in the aerospace age

by MAJOR GENERAL KENNETH P. BERGQUIST, USAF, Commander, Air Force Command and Control Development Division, Air Research and Development Command, Laurence G. Hanscom Field

AN ELECTRONICS MANAGEMENT complex is taking shape at Hanscom Field, near Bedford, Mass., that heralds the first all-out attack on the increasingly complicated and growing numbers of problems of communications and control in this aerospace age. Partner in what is to be a powerful team effort bringing together Air Force research and development, logistical and operational commands, is ARDC's Air Force Command and Control Development Division.

This mission of AFC^2D^2 is to plan, program and manage the development and test of command and control systems to permit exercise of weapon command and executive control of AF operations; to insure proper integration of control systems and associated weapons; and collaborate with the user commands to insure appropriate compatibility of independent systems and to provide within available resources unique technical support for these systems. This is fundamentally a management responsibility that will exist throughout the life of a system. Any system is likely to need improvements or modifications to meet changing needs. And these will require research and development.

Development and integration of command and control systems covers a relatively new area of responsibility. The systems on which we will be working are those used to collect, transmit, process and display the data required for timely decisions needed for control of weapons and to facilitate decisions, thus the term "command and control."

These systems control or influence decisions concerning the operation of many of our major weapon systems. Some affect the operations of other elements of the government, including the Federal Aviation Agency, the Weather Bureau, and all elements of the Department of Defense. Such systems are the products of the Hanscom Complex.

Concurrency

In bringing the command and control systems together into one organization, the principle of concurrency is to be vital to our management. Already proven in the development of the Atlas and other ballistic missile programs, the concept of concurrency means that we have to be concerned simultaneously with operational employment, development, testing, training, production, supply and other logistics aspects of a weapon or space program.

Here, at Hanscom, will be a number of research, development, logistics and operational type organizations—military, other government, and civilian contractors. Each may be working on different aspects of the problem, but all will be following the same time schedule, with the same dollar program, with the same technical and operational goals. Equally important, we'll be on the same team, speaking the same language.

In developing the ballistic missile, which served to put us on the edge of space, time was reduced by bringing together in the early planning, programming and budgeting cycle, and keeping together to production, a team that included the developer—ARDC, the logistician—AMC, and the user—SAC.

Here, now, we're faced with a similar problem. We've got to cut the time it takes communications and control systems to move from concept to production if we are further to advance our aerospace and military capability. We are confident that the same team approach will work.

The serious competition of the Soviet Union and the advent of ballistic missiles have caused a shrinkage of our available time, both from a viewpoint of the time required to develop new military systems and the reaction time demanded by the threat of a ballistic missile attack.

The survival of the free world depends largely upon the success of the Air Force mission. That mission in turn depends upon the efficient and economical use of our resources. While our military strength is now superior to that of the Soviets, we must see to it that we develop our present resources so that the United States will maintain this superiority.

Weapon System Management Concept

Technologically, we are advancing rapidly. But the consequent increasing complexity and cost of Air Force equipment and the growing demands for improved weapon and support equipment make it clear that we must continue to modernize our management techniques to keep pace with technological advances. Aircraft, missiles, communications and support equipment components can no longer be designed, developed, or managed separately. Instead, they must be handled as "packages," consisting of a weapon or group of weapons with all components, related facilities, equipment, supply support, and trained manpower. It is this need for the package approach that has brought the Air Force to the use of the weapon system management concept.

(*Continued on page* 32)

— GOVERNMENT —

U.S.–SOUTH AMERICAN ASW EXERCISES are being conducted to demonstrate U.S. Navy anti-submarine warfare procedures and equipment to eight South American nations. The exercises, which began in August, will be completed in December.

HOW THE DEFENSE DEPARTMENT makes use of its inventory and the taxpayer's dollar is being set forth in a series of reports prepared by the Office of Assistant Secretary of Defense (Supply and Logistics). As requirements for weapons change, the requirements for defense supply inventories change. The first of these reports explains how excess inventory is put into a "defense matching process" whereby any equipment in excess that is useable either on a direct match or on a substitute basis is transferred between inventory managers of the various services. These transfers eliminate the need for purchasing new equipment and thus save money, according to the report.

COMMUNICATIONS NETWORK connects engineers' ice cap camps at the U.S. Army Polar Research and Development Center in Greenland. The Signal Section of USAPR&DC has the task of coordinating this entire communications system which includes an internal radio net between the main Corps of Engineers base camp and the center's two active R&D projects. For the first time in arctic communications, a radio teletype circuit is being installed to interconnect all three R&D camps, according to the Army. An amateur radio station KG1BA has been set up to provide personnel with a means of contact with their families.

ARMY ENGINEERS have established a new agency for research in geodesy, intelligence and mapping. Known as the Geodesy, Intelligence and Mapping Research and Development Agency, the agency will provide the Armed Forces with more accurate and faster equipment and techniques in these fields of military operations.

VHF CHANNELS presently used by the Government cannot be spared for TV broadcast use, according to the Office of Civil and Defense Mobilization. The announcement was made in answer to a request from the Federal Communications Commission for exchanging Government radio frequency allocations between 222 and 450 mc, in return for some non-Government frequency space in the present high frequency television band. OCDM, with the concurrence of the Defense Department, stated that "military operational readiness" needs require the use of frequencies between 225 and 400 mc, which is the primary tactical communication band. The FCC had requested the exchange of frequencies in order that the TV broadcast bands would be contiguous and in the very high frequency part of the spectrum, instead of separated in the VHF and UHF parts of the spectrum.

INDUSTRIAL SECURITY ORDER containing revised standards and procedures for determining whether or not defense contractors and their employees may be authorized access to classified data has been issued by the Defense Department. Under the directive issued July 28, individual defense workers will be given the right to respond to the statement of reasons why an access authorization may be refused them and they will have the opportunity to appear personally in support of their application for access to classified information. One of the main areas of contention in the security program had been whether or not individuals who were denied access to classifed data had the right to confront witnesses presenting adverse statements about the individuals. The directive grants individuals the right to cross-examine witnesses, except in certain instances. For example, the individual would be denied this right if the witness is a confidential intelligence agent.

LUNAR TERRAIN STUDY provides surface data for selecting land sites on the moon. Conducted by the Interior Department's Geological Survey for the U.S. Army Chief of Engineers, the study consists of three diagrams and an accompanying text. Informamation gained from the study also will serve as an aid in designing telemetering instruments and a lunar surface vehicle.

ARMY'S STRAC is displaying its strength and combat readiness in a series of exercises, two of which are being conducting this month. The Strategic Army Corps will demonstrate its readiness to deploy and the Army's ability to react swiftly to deter aggression during a 10-day mobility exercise called Grand Isle. The site of this exercise has not been announced. South Wind, a command post and field training exercise, will emphasize organizational doctrine during a 15-day maneuver at Fort Bragg and Camp Mackall, N. C.

SAC RECEIVED 12 B-58 HUSTLERS from the Air Research and Development Command in August to replace a part of the Strategic Air Command's B-47 Stratojet force. These Hustlers, which fly at twice-the-speed-of-sound, are the United States' "first operational supersonic bombers," according to the Defense Department.

CONTRACTS: ARMY: International Telephone and Telegraph Corp., Federal Div., production of transmitting beacons and transponders to guide the Lacrosse artillery guided missile, $5.3 million; Motorola, Inc., radar data transmitting and receiving sets, $2.5 million; Bendix Corp., Bendix Systems Div., satellite communication equipment and ground communication terminal equipment for Project Advent, an over-all satellite communications program, $8.4 million; Specialty Electronics Development Corp., transportable manual telephone central office systems, $1.7 million. NAVY: Sylvania Electric Products Inc., Waltham Labs, electronic data processing equipment to direct radio telescope, $3.2 million; Telecomputing Corp., lightweight airborne radar systems, $1.7 million; General Electric Co., Ordnance Dept., fabrication of new type Polaris inertial guidance systems, $1.2 million. AIR FORCE: Tung-Sol Electric Inc., one million electron tubes for use by various Government agencies, $2 million.

— INDUSTRY —

LOCKHEED AIRCRAFT CORP. will continue the development of a communications system for data readout and satellite control for the Air Force's Discoverer, Samos and Midas satellite programs, under a $78 million Air Force contract given to its Missile and Space Division. The award broadens the division's activities to include systems engineering and technical direction for the communications and control subsystem for the reconnaissance (Samos), missile interception (Midas) and space capsule recovery (Discoverer) satellites.

RADIATION INC. of Melbourne, Florida, has designed, built and installed a giant Ground Data Processing Center and companion Airborne Data Acquisition System for General Electric's Flight Test Center at Edwards Air Force Base, California. The new system will speed flight testing of GE's J93-3 turbojet engine slated for the B-70 Valkyrie, USAF's 2,000 mph bomber now under development.

L. M. ERICSSON TELEPHONE CO. of Stockholm, Sweden will install an automatic central exchange to serve 10,000 subscribers in Bangkok, Thailand. The exchange, which is being built under a $1 million contract from the Kingdom of Thailand, is scheduled to be in operation early in 1963.

BELL AERO SYSTEMS CO. of Buffalo, N. Y. will design inertial navigation equipment for use in future military satellites. The firm will provide digital velocity meters, which are extremely precise components designed to measure missile acceleration and velocity. Under a contract from Lockheed Aircraft Corp., Missile and Space Div., Bell will produce the meters for use in the Air Force's Midas and Samos satellites. Midas will provide an early warning system of defense against hostile intercontinental ballistic missiles. Samos is a satellite reconnaissance system.

BAUSCH & LOMB INC. has manufactured a precision measuring instrument which was used in the recent series of successful launchings of Polaris missiles from a submerged submarine. Called an Azimuth Error Indicator, the instrument performs a measuring function that permits the azimuth mechanism in the missile's inertial guidance system to receive constant precise settings from the fire control system prior to launching.

SIEGLER CORP. of Los Angeles is introducing a new electronic instrument which can test telephone circuit signals with greater efficiency than conventional methods, according to the company. Called a Swept-Band Transmission Measuring Set, the new device discloses if there is any defect in a telephone ciruit and, in some cases, can determine the type of defect and its location. Eliminating time consuming methods, the new device can test 14 circuits in the time required to examine one telephone circuit by manual methods.

COLLINS RADIO CO. is developing a lightweight airborne weather radar which represents a new concept in design for the airlines and aircraft in the general aviation fleet, according to the company. Weighing less than 50 pounds, the radar contains transistorized, printed circuitry. (*Continued on page* 38)

"STRIP THE COMMUNIST GIANT OF ITS PROPAGANDA AND SEE THE NAKED IMAGE FOR WHAT IT REALLY IS"

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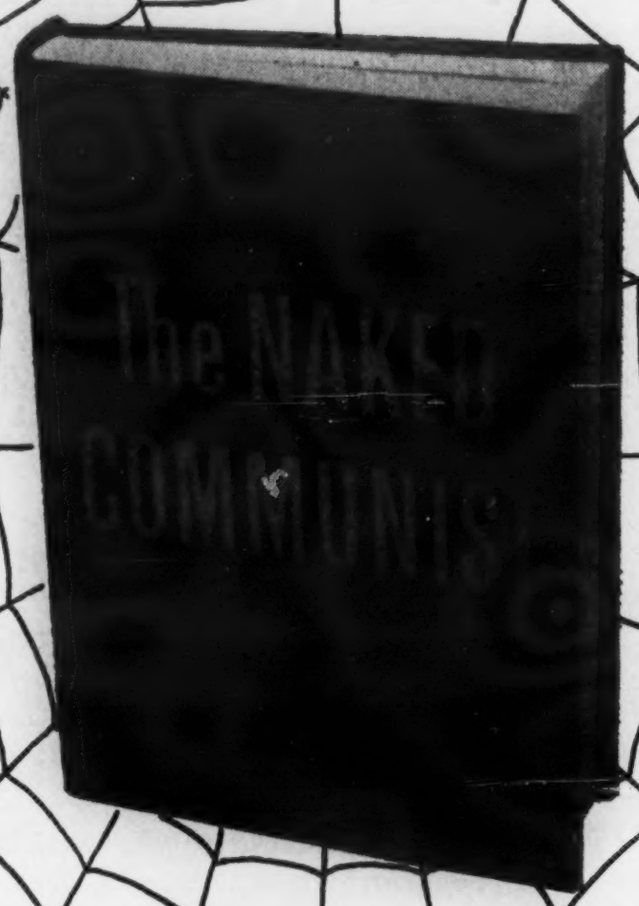

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Did the early Christians practice Communism?

What is the secret weapon of Communism?

ABOUT THE AUTHOR

W. Cleon Skousen is the Chief of Police in Salt Lake City, Utah. He is a national authority on the subject of Communism. At the recent IACP Conference in New York City he was a featured speaker on the subject. His book is based on sixteen years of experience with the F.B.I. During his five years at Brigham Young University as assistant to the president and as a professor, he completed additional research and wrote this book. He has lectured throughout our country on Communism. A lawyer, professional law enforcement officer, administrator, Chief Skousen is married and is the father of eight children.

The Naked Communist is divided into six basic parts. Beginning with a background of historical events, it leads the reader into modern day Communism and the sinister web that is spreading out—trapping free people. An alert America is a free America. The substance of this book is something you would want your children to know about.

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Electronic Systems Center

(*Continued from page 26*)

also helps support development work on new systems during their development and test phases.

Then, there is the Equipment Standardization Division, which was set up to eliminate costly duplication of development and design efforts. A tropo antenna, for example, designed for the Aleutian Segment of the DEW Line may very well serve in the communications circuitry of several other systems.

Electronic System Project Office

Now, to get down to the electronic systems themselves. Each of the thirteen systems is being developed and implemented under the direction of an Electronic System Project Office, an ESPO, as we call it. We have grouped the thirteen systems under three directorates which we have labelled Command and Control Systems, Intelligence and Warning Systems, and Weapons Control Systems. It is at this directorate level that we can take our first good crack at insuring compatibility between systems. Though uniqueness is the standout characteristic of electronic systems, there is enough similarity between the systems under each directorate to permit serious consideration of compatibility and integration. Whether future electronic systems will be able to fit under our present directorates will be an interesting question for the future to decide.

Each of the Project Offices or ESPO's is quite similarly organized. In fact, we are seeking to effect a standard organization in all ESPO's if possible, though standardization in an environment of uniqueness is hard to accomplish. At present each ESPO has five branches: Program Integration, Financial Management, Procurement-Production, Logistics, and Civil Engineering.

To return to the operation of the ESPOs, I mentioned a few moments ago that they "direct" the development and implementation of the system. I could just as easily have used the word "manage." The ESPO manned jointly by ARDC and AMC is the focal point for all Air Force activities regarding a particular system. Quite often it has liaison representation, therefore, from several other commands—such as the Air Training Command, the Air Defense Command, SAC, and even in certain cases, the Royal Canadian Air Force. There is a continuing requirement for inputs from these commands—particularly the using commands—and a need for their being constantly informed of the status of the system.

Next, the ESPO is the connecting link between the Air Force and the system prime contractor. As such, the ESPO is responsible on behalf of the Air Force for directing and supervising the activities of the contractor. The ESPO establishes the master implementation schedules for approval by Headquarters USAF and then monitors the efforts of the contractor to insure that these schedules are met.

This function of the ESPO is vastly more than "score keeping." Guidance and direction from Headquarters USAF are, necessarily and properly, very broad brush. USAF-approved system parameters, system configurations, system schedules, and system budget are guide lines at best, for the very reason that today's electronic systems are being approved for development and implementation as soon as the scientific principles on which they are based have provided the minimum reasonable assurance of leading to a workable system. This brings us back to that Concept of Concurrency. The urgency of our need for the latest technological development precludes our waiting until every theory and concept has been thoroughly tested and proven. Headquarters USAF must initiate action as soon as there is that "minimum reasonable assurance" of success. This means, of course, that we must often carry on detailed and confirming research and development while we are implementing. But our point is that guidance and direction from Headquarters USAF to the ESPO is only of the most generalized nature. The Project Office is, therefore, placed in the position of constantly having to make the detailed decisions as the program develops and the theories and concepts prove out—or don't prove out. The Project Office must be organized and staffed (and I might add "inspired") to make these detailed decisions, on-the-spot, or the program will come to one of those grinding halts. Time is truly money in these programs. Neither Air Force management, as represented by the ESPO, nor industrial management, represented by the prime contractor, can enjoy the luxury of leisurely decision making.

System Cost

One of our greatest difficulties with today's electronic systems, as well as weapon systems, is that it is almost impossible to estimate accurately and in a detailed breakdown the cost of a new system. One of the obvious roads the ESPO chief has to tread is the one back to Washington with another request and justification for adjustments in funds and program guidance.

Finally, in regard to the subject of the ESPO, I want to emphasize that it is the Project Office which is charged by Air Force regulation (20-10) with the accomplishment of results—and "results" is the unequivocal word used in the regulation. What my staff must do is to insure that we get favorable results from the project offices.

Having spent quite a few moments on the operation of our project offices, I would like to add just a few thoughts about our general philosophy of operation at the Center. First, we expect to be able to do a better job of carrying out AMC's functions in regard to electronic systems by centralizing the efforts of the project offices. To borrow a term from the AC&W business, we expect to gain the advantage of "cross telling." Second, we will continue to operate through the medium of the industrial prime contractor. If there is a change here it will be in the degree to which we can assume greater management responsibility at the Center. Third, we will continue to use wherever practical the Rome Air Materiel Area and the Ground Electronic Engineering Installation Agency. These two AMC organizations deal in the procurement and installation of electronic equipments at less than the system level. Where it appears preferable to use Government furnished equipment, as opposed to contractor furnished items, we will go to Rome for them. Fourth, we will integrate the efforts of the Logistical Support Management earlier and more thoroughly than has been the practice in the past. The LSM is that Air Materiel Command organization (usually an AMA) charged with the duties of system maintenance and logistical support after the system has been declared operational. Finally, we hope to achieve a better balanced financial posture by securing from USAF Headquarters funding authority by system. One of our most difficult problems in the past has been to get the proper money at the proper time. This difficulty has existed because USAF fund allocations have been made in the past by category. In regard to Ballistic Missiles, they are now made on a system basis. We shall be doing our best to work out with USAF Headquarters acceptable procedures for C & E system budgeting by package and allocation by increment.

Now, the creation of the Electronic Systems Center as an Air Force management tool is an outgrowth of the

so-called Weapons Systems Management Concept. I would like to stress for a few minutes that though the electronic system is grouped generically with the weapon system as far as regulations go, there are in fact many differences between them. Their similarities, it seems to me, are limited to the fact that *all* weapon systems and electronic systems are complicated, costly, and controversial—and in need of specialized management. Beyond that they are strikingly dissimilar.

Custom Made System

The first of the distinctions between the C & E system and the weapon system lies in the fact that each C & E system is *custom* made. We build only "one each" DEW Line, or SAGE system, or USAF worldwide communications network. With aircraft or missiles, we are always concerned eventually with quantity production. The implications here are tremendous from a management point of view. For example, the phases in the production cycle of each new aircraft are very nearly identical; that is, there is a drawing board or creative engineering phase; there is a prototype construction phase with associated testing of components; there is, next, a testing phase for the prototype model itself, usually including field testing under an operational environment; and finally, there is the quantity production phase. These well-defined and logically sequential phases simply find no parallel in the C & E system. In fact, such phases in the cycle, as apply to one system will not do for the next. Above all, there never is a prototype, as such; and there never is a quantity production phase, except of certain components. We produce "one each" C & E system, and it is a custom job from beginning to end.

R & D Continues

Let me carry this point one step further. With the C & E system there is no cut off point for research and development. By and large R & D continues unabated throughout the life of the project, and even after it has been turned over to the using command. This fact has two very important implications: first, it means that AMC and ARDC must indeed be a two horse team. Procurement and production of some equipments may very well begin as soon as a project is authorized, while others are still in that category of scientific speculation. Such a team relationship calls for very mature adjustments with true team spirit. Second, the continuing R & D means that there is no such thing as a permanent or fixed master implementation schedule. If R & D comes up with a better piece of equipment or a better system configuration, and that new equipment or configuration is acceptable to Headquarters USAF, then a new master implementation schedule must be drawn up.

Usually a decision to incorporate an improved component or configuration means additional costs and slippage in schedules. Occasionally it can and does mean just the opposite. But if we did not permit continuing R & D, we would most certainly deliver an outmoded and ineffectual system. The twin spectres of inflation and obsolescence cast their dark shadows over the drawing board of the electronics engineer, no less than over the drawing board of the aeronautical engineer.

As a matter of fact, I recently saw on the wall of an engineer's office in the plant of one of our electronics contractors a witty yet ominous little sign which read: "If it works, it's obsolete." From a management point of view, I presume this is an acceptable bit of stimulating philosophy. The awkward fact is that there is the element of truth in the phrase. What the phrase does not touch upon, however, is: what if it doesn't work? The complementary phrase that came to mind was: "If it doesn't work, you're doomed." The phrase isn't as witty, but I trust it is as realistic.

Little Guidance

In my opening remarks, I stated that it is as if we were venturing forth at Hanscom on a journey into the unknown. I repeat: we have little historical precedent to go on. And what's more we are being propelled at an accelerating rate by scientific progress. About all we have for guidance are the two out-of-bounds markers: "If it works, it's obsolete" and "If it doesn't, we're doomed." If I may switch to the lighter metaphor someway, we've got to stay in the narrow fairway between those two out-of-bounds markers. Our electronic systems must work and for a reasonable period of time, and at the same time we must find ways to build better ones. And, let us take note of the big hazards in the middle of that narrow fairway: we must build these systems at a price this nation can afford.

The time has come for the foursome of ARDC, AMC, the Using Command, and Industry to tee up the ball and start swinging.

Command and Control

(*Continued from page* 27)

To comprehend weapon system management in the Air Force, it is necessary to understand "Weapon System" and "Support Systems," as well as "WSPOs" (Weapon System Project Offices) and "ESSPOs" (Electronic Supporting System Project Offices).

A "Weapon System" is a composite of equipment, skills and techniques forming an instrument of combat which usually, but not necessarily, has an aerospace vehicle as its major operational element. The complete weapon system includes all related facilities, equipment, materials, services, and personnel required solely for the operation of the aerospace vehicle or other major element of the system. As a result, the instrument of combat becomes self sufficient in its intended operational environment.

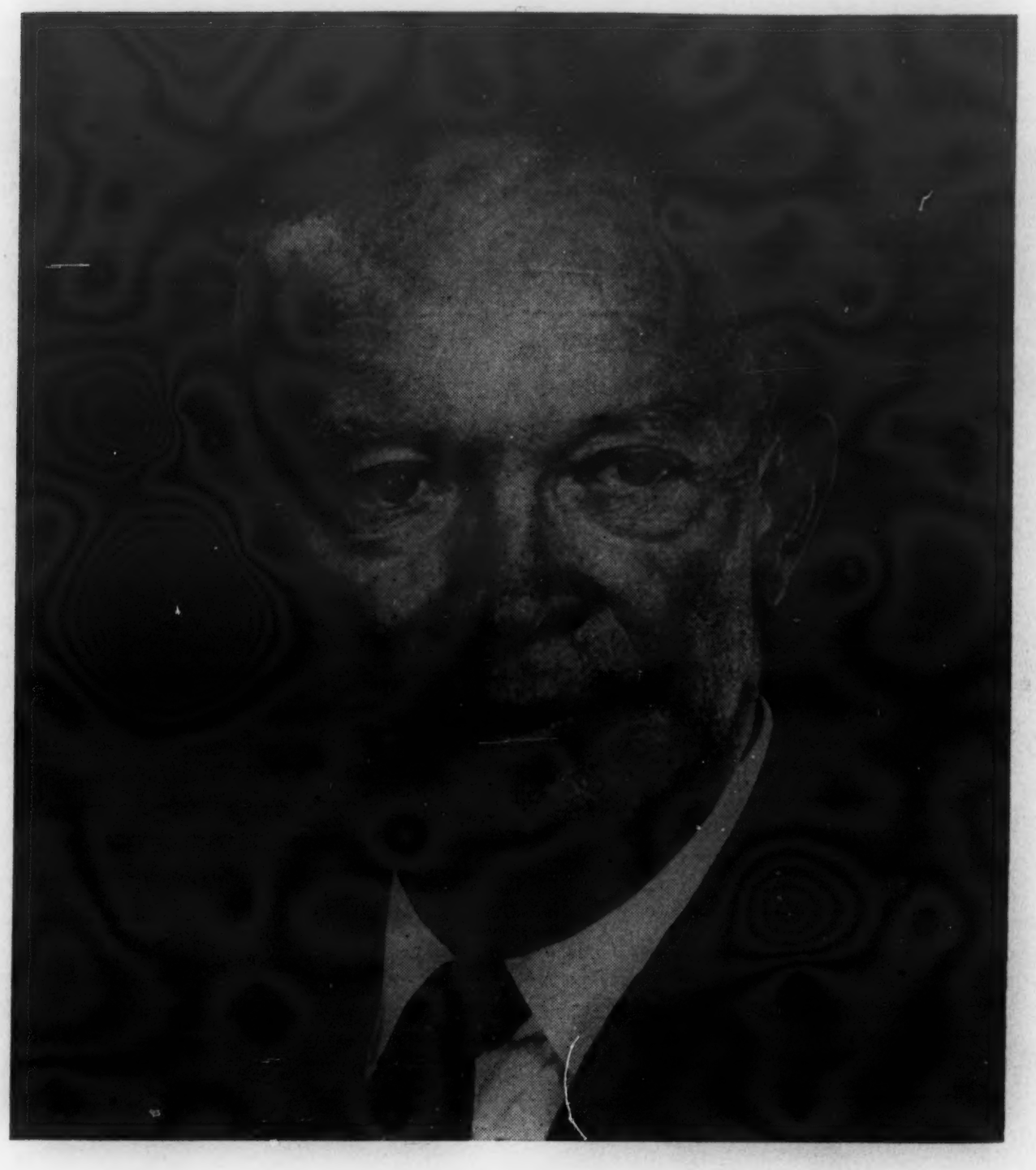
A "Support System" is a composite of facilities, equipment, skills and techniques which, while not an instrument of combat, has the capability of performing a clearly defined function in support of an Air Force mission.

The weapons systems concept comprises two major ideas. First, it recognizes the need for concurrent preparation and integration into the force structure of the Air Force of the aerospace vehicle or other mission equipment and the related support equipment, facilities, training, skills and personnel which together form a "Weapon System." Second, it formalizes a management technique within the Air Force to fuse the efforts of Air Force functional activities, other government agencies, industry, and science to assure economical and timely introduction of a weapon system into the operational inventory. A direct outgrowth of the systems management concept are WSPOs and ESSPOs created by the Air Force to manage each weapon or electronic system.

I'm sure you realize that these offices have two principal parts, ARDC and AMC. ARDC personnel are responsible for all technical aspects of electronic system development. including establishment of system configuration to meet operational requirements. Establishing this configuration sets the basic management ground rules that will govern the system throughout its useful life.

The ARDC side of the ESSPO also

(*Continued on page* 37)



Our liberties rest with our people, upon the scope and depth of their understanding of the spiritual, political, and economic realities which underlie our national purpose and sustain our nation's security. It is the high mission of the Industrial College of the Armed Forces to develop such understanding among our people and their military and civilian leaders. So doing, we will make the wisest use of our resources in promoting our common defense. The Industrial College has been a guidepost pointing to the greatly increased quality of our defense capacity; it must continue to point to an ever-ascending progress for the years ahead.

Dwight D. Eisenhower

(The remarks above were made on September 6 by President Eisenhower at the dedication of the new building at the Industrial College of the Armed Forces.)

(L to R) Gen. L. L. Lemnitzer, Chairman, Joint Chiefs of Staff, President Eisenhower, Lt. Gen. G. W. Mundy, USAF, Commandant, ICAF, enter new ICAF building.

A SIGNAL STAFF REPORT

ICAF SERVES THE NATION

The flags of the three services in the interior of the Industrial College of the Armed Forces.

A COMPARISON OF a graph of the rate of scientific and technological developments during the past 50 years with one showing the rate of political and economic changes, would be startling in at least one respect: the similarity of the fantastically rising curve.

Science and technology have provided us with an awesome spectacle of unlimited opportunities and at the same time with a grave threat to our survival. They have shattered traditional concepts of time and distance, have revolutionized the means of communication, production and distribution, and have created a new source of almost unlimited power potential.

At the same time, the economic and political positions of the major nations of a generation ago have undergone profound changes. Trade patterns have been reversed. Old empires have tottered and fallen. New nations have arisen—and are arising today — at an unprecedented rate. Each of these nations has its own political aspirations and economic desires and intends to realize them through whatever means or alignments necessary.

But behind these spectacular developments is yet another change, so all-pervading as to be almost unrecognizable in its totality: the nature of the power struggle between the Communist Empire and the non-Communist world.

It is a power struggle unlike anything the world has ever experienced. It is a conflict between two social-political-economic systems and one which recognizes no national states, fixed boundaries, or battle lines. It is fought everywhere, at all times, employing a variety of weapons that no military genius of the past would have recognized as conventional: the arts and sciences, theatres and public forums, athletic competitions and trade fairs, political infiltration and subversion, and economic pressures, grants, and controls.

Outstandingly overshadowing these aspects of the total conflict is the military threat, so terrible in its possibilities that it tends to hide the other aspects. To offset the military threat, we must have, in being, a force of sufficient strength, variety, and flexibility, to *deter* a military assault against our democratic system. To do otherwise would be to invite complete disaster.

The need for this deterrent force is obvious beyond question. But if this force is to be, and to remain, effective, it must constantly be re-equipped with the modern means that science, technology, and industry can provide. This is an extremely costly process, costly not only in terms of money, but also in the requirements for materiel, resources, and trained manpower to operate the sophisticated weapon systems. Therefore, the military needs must be carefully evaluated in terms of the economic capability of this nation and the Free World.

But even if we maintain a deterrent force sufficiently strong to prevent a direct military assault on the United States, we must still recognize that this deterrent force can not bring about a decision in the economic, political, and psychological areas of the total conflict.

Mr. Khrushchev obviously recognizes the effectiveness of our military deterrent and has no desire, at this time, to resort to major military ventures that would unleash it forthwith. He made this clear when he said "In our day there are only two ways: peaceful coexistence or the most destructive war in history. There is no third way."

But lest anyone interpret "peaceful coexistence" to mean "live and let live," Khrushchev was careful to say, "We say to the leaders of the capitalist states: Let us try out in practice whose system is better, let us compete without war."

The outcome of this "peaceful coexistence—competition" was predicted by him as follows:

"We believe that ultimately the system will be victorious on the globe which will offer the nations greater opportunities for improving their material and spiritual life. It is precisely socialism that creates unprecedentedly great prospects for the inexhaustible creative enthusiasm of the masses, for a genuine flourishing of science and culture, for the realization of man's dream of a happy life, a life without destitute and unemployed people, of a happy childhood and a tranquil old age, of the realization of the most audacious and ambitious human projects, of man's right to create in a truly free manner in the interests of the people."

Mr. Khrushchev, therefore, not only obviously predicts the ultimate success of the Communist plan to destroy the Free World using his plan of "peaceful coexistence," but also gives the newly emerging and underdeveloped nations of the world a promise of paradise achieved — if they will but embrace Communism.

The Free World must be prepared to face this new challenge as effectively and resolutely as we faced the military threat, without, however, permitting the deterioration of our military posture. (If we were to permit our deterrent strength to decrease, then we would be faced not only with the new and complex problems of the "cold war" but with military blackmail as well.)

It will not be enough to fall back on such cliches as "a nation of Yankee traders can beat anyone else in this game" for this is not a trading competition between two free enterprise systems but the systematic employment of economic power—frequently without regard to true costs —in its totality: in furtherance of immediate national aims, in support of the long-range objectives of the system, in support of the scientific and technological race, in support of the military forces, and as a separate and distinct weapon to gain control of the economies—and thus political control—of other nations.

During educational field trips, ICAF meets with industry. Pictured here is one group concerned with the area and study of electronics and the effect of this vital segment of our industrial complex on the national economic situation.

During the past generation, it has become increasingly clear that the economic readiness of a nation: i.e., the state of its science, the degree of its technological development, the nature and type of its industrial capacity and organization, the availability and quality of the natural resources, and the availability of trained scientific and technical manpower, may well provide the key to the understanding of the total intentions and capabilities of that nation, not only in this period of "protracted tensions," but also in a limited conflict, and in a total war.

In recent years, the Industrial College of the Armed Forces, alert to the increasing tempo of the economic cold war between the Free World and the Soviet system, has reshaped its curriculum to place added emphasis on the economic requirements of the United States' national strategy under conditions of continuing international tensions, as well as under limited war conditions and the initial attack, post-attack, and recovery phases of a total war. At the same time, it has expanded the study of the economic readiness of the nations and regions of the world against the backdrop of their social, political, and military organizations and aspirations.

It may seem surprising to the casual observer that a joint educational institution on the highest level of the educational system in the Department of Defense, operating under the direction of the Joint Chiefs of Staff, should devote itself to the study of economics of national security planning. Yet, it is but the recognition of the fact that our top level security planners, both military and civilian, must devote more and more of their time to the analysis of the impact of their plans on the national economy, and of the ability of the economy to support those plans.

The Industrial College of the Armed Forces has been fortunate through the years to have had commandants who have given unselfishly of their time to the modernization of an educational system outstandingly unique and of proven national value.

The selection of senior officers from all of the military services and key civilian officials of governmental agencies and departments to attend the Industrial College is in the hands of trained experts. Only 150 of the most deserving and, with promising future potential, are chosen yearly to attend the resident course. In an atmosphere of academic freedom, and devoid of any operational responsibilities and individual service or departmental pressure, these students study all aspects of the national and international scene not only in the "classroom" but by means of field study trips that take them to the major areas of the world. The synthesis of their one year of study is a series of reports based on their own findings and in which they propose national security programs covering all possible conditions of international relations and domestic affairs. These reports are made available to interested official agencies.

In addition to the resident course, which has already provided the country with some 1,900 graduates who now play important roles both in the government and in civilian life, the College also extends its program by means of a correspondence study course and a program of National Security Seminars, both of which are based on the resident course.

The correspondence course, "The Economics of National Security," consists of 22 bound volumes and is available to qualified military officers of all components, and to civilians in industry, government, the professions, labor, and civic activities. Since the inception of the course in 1950, some 9,200 individuals have completed this course, about one half of them civilians.

The two week National Security Seminars, which were originally established in 1948 to provide training for senior reserve officers, are now presented each year to combined military and civilian audiences in 14 cities throughout the country. While the instructional program consisting of about 30 lectures plus forums, film presentations, and field trips, is presented by two teams of specially trained military instructors assigned to the Industrial College, the seminars are sponsored and operated by local committees. Through the end of last June, 196 seminars have been presented in 110 different cities. In all, 52,000 individuals have completed the seminars.

To carry out this unique educational mission, the College is divided into two academic segments: the School of Resident Studies and the School of Extension Studies. The Administration Department provides the necessary administrative and housekeeping support for both schools.

The Commandant of the College and the two Deputy Commandants are from the three military departments. The positions rotate periodically among the military departments so that each is always represented. Each Deputy Commandant heads one of the Schools.

The Commandant also has available the services of a Senior Educational Adviser, and of advisers assigned to the College by the State Department and the Office of Civil and Defense Mobilization. The assignment of the latter two advisers is indicative of the recognition the College has gained among the civilian agencies of the government.

Also available to the Commandant is the advice and counsel of the Board of Advisers, a group of 12 outstanding leaders in government, industry, labor, and education. They serve at the invitation of the Commandant and meet with him periodically to review all aspects of the College's program.

The Industrial College of the Armed Forces has become a powerful instrument for making the American citizen more deeply and actively aware of the problems of national security and his own responsibilities for coming to grips with them. Its broad mission, in consonance with policies of the Joint Chiefs of Staff, permits it to adjust its program to reflect the latest changes in the international atmosphere, and to provide the nation with a realistic appraisal of the national security requirements.

Editor's Note: Worthy of AFCEA's vigorous support, the educational mission of ICAF is exemplified by its two-week National Security Seminars for 1960-61 held in the following cities. There is no surer or better way to receive an indoctrination in what makes our national security tick, what are the major national problems and what possible solutions are open to our members to assist in strengthening our freedom and heritage.

Seminars will be held in:

Bethlehem, Pa., Sept. 26-Oct. 7, 1960
Cheyenne, Wyo., Oct. 3-Oct. 14, 1960
Albuquerque, N.M., Oct. 31-Nov. 11, 1960
Milwaukee, Wis., Nov. 7-Nov. 18, 1960
Riverside, Calif., Dec. 5-Dec. 16, 1960
Honolulu, Hawaii, Jan. 9-Jan. 20, 1961
Birmingham, Ala., Jan. 16-Jan. 27, 1961
Lubbock, Tex., Feb. 6-Feb. 17, 1961
Evansville, Ind., Feb. 27-Mar. 10, 1961
Yakima, Wash., Mar. 6-Mar. 17, 1961
Wichita, Kan., Apr. 3-Apr. 14, 1961
Winston-Salem, N. C., Apr. 10-Apr. 21, 1961
Wilmington, N. C., May 8-May 19, 1961
Newark, N. J., May 8-May 19, 1961

Command and Control

(*Continued from page* 32)

is responsible for incorporating latest developments and for assuring the technical excellence of all equipment throughout development, test and production of the system. AMC personnel in the ESSPO are responsible for procurement, production, supply and maintenance of the black boxes.

Having mentioned both ESSPO and WSPO as similar system project offices, perhaps it would be well at this time to note a significant difference. Weapon systems are essentially revolutionary in nature. A new weapon is required, designed, tested and brought into production. An old weapon is phased out because of obsolescence. Electronic systems are mainly evolutionary, although not always so. Existing systems must be updated, automated, and improved without interfering with the day-to-day operation. Rarely is an electronic system designed from the beginning to replace an existing system and rare indeed is the piece of electronic equipment that is declared completely obsolete. A somewhat different method in operation of ESSPO from that of the WSPO must and is thereby evolving through day-by-day operations.

ADSID

The team approach was applied more recently in the air defense area with the establishment of the Air Defense Systems Integration Division (ADSID) here at Hanscom. For a number of years, the Air Force had been vitally concerned with the task of integrating both the air defense ground environment and the weapons associated with the ground environment to insure this nation the best possible air defense capability.

The ADSID was a tri-command organization, or complex, that brought together a developer—ARDC, a logistician—AMC, and an operator—ADC, to integrate the items ancillary to SAGE and of weapon systems with the ground environment. This organization clearly focused on the necessity for insuring that all systems would operate together when developed. This is integration.

The Air Force, in bringing these gigantic electronic environments into being, necessarily pioneered and forged new management methods. Where methods didn't work, they were thrown aside.

One important lesson learned is that ground environments cannot be achieved by the traditional odds-and-ends black box procurement. To achieve the desired system performance, the environment must be analyzed, designed, and implemented as a system—the developer, logistician, and operator getting together early and remaining together. Failure to recognize this very basic fact can result in costly blunders and the amassing of the biggest non-operating "electronic do-it-yourself kit" known.

Reorganization of ARDC

On 6 October 1959, a reorganization of the Air Research and Development Command was announced. Making use of lessons learned in Ballistic Missile Division and ADSID, the reorganization was dedicated to one purpose—to insure that ARDC remains an active, dynamic force for the rapid translation of technology into useful military systems.

Basic to the organization was the command philosophy of integration and concurrency in the development of these systems, that is, all elements of a total military system must be developed in an integrated and concurrently phased manner.

ARDC now has four major field divisions: the Air Force Ballistic Missile Division at Inglewood, California; the Air Force Command and Control Development Division; the Wright Air Development Division, Dayton, Ohio; and the Air Force Research Division, Washington, D. C.—the latter not co-located with ARDC Headquarters. Each Division Command has a staff to manage and supervise research and development programs in his functional area of responsibility. And with the addition of logistician and the operator counterparts, the divisions become operating complexes.

Now that I have treated the concepts behind the ARDC reorganization, let me turn to the matter of our ARDC organization for development of command and control systems. I have implied that modern weapons such as the ballistic missile: (1) cause a compression of time for decision, (2) lend an irrevocable nature to war decisions, and (3) permit a greatly expanded global theater of aerospace operations.

Command and Control Complex

All these operational factors lead to an urgent need for modern assists to decision makers. Electron technology and data processing are being looked to as the logical assist tool. As a consequence, there has emerged a family of electronic systems forming a USAF command and control complex, which is being used to put the commander back in the driver's

(*Continued on page* 42)

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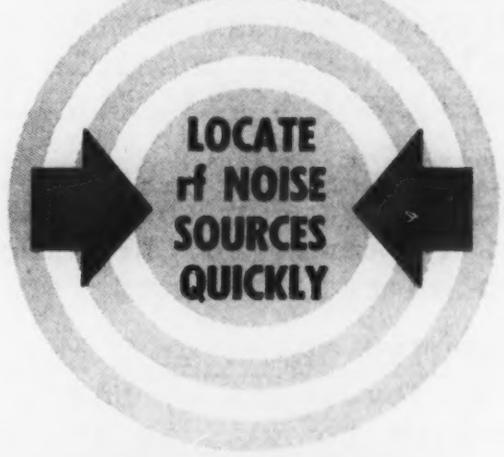
MODEL 500
INTERFERENCE LOCATOR



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It's a compact, portable, rugged, versatile instrument—engineered and designed for most efficient operation *in practical field use.* It features a transistorized power supply, meter indications proportional to carrier strength as well as sensitivity of 5 microvolts minimum for 5% meter deflection over entire tuning range.

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287 Marshall Street, North Adams, Mass.

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THE MARK OF RELIABILITY

Signalgram (*Continued from page 29*)

COSSOR COMMUNICATIONS LIMITED of Middlesex, England has introduced several new models of VHF equipment. The smallest model in the group is an AM receiver designed to fit into the pocket of a suit. The aerial is incorporated in the lead to the earphone and the set is powered by re-chargeable batteries. Another model, a mobile transmitter-receiver for use on motorcycles, is said to give good results over distances of up to 25 miles.

INCREASED DETAIL IN AERIAL PHOTOGRAPHY is possible by combining a TV type light source with a high precision autofocus rectifying enlarger, according to Bausch & Lomb Inc. and LogEtronics Inc. These firms have built such a unit under Navy sponsorship for use at the Naval Photographic Interpretation Center, Suitland, Md. This unit makes it possible to prepare aerial prints with maximum detail in dark shadows and bright highlights, it is said.

HEWLETT-PACKARD CO. of Palo Alto, Calif. has prepared a brochure describing latest techniques for the continuous monitoring of radar noise figures. The 11-page booklet reviews the theory of automatic noise figure measurements and outlines radar system requirements for integral noise figure meters.

COMPUTER TRANSISTOR said to be capable of handling 100,000,000 signals a second has been developed by Radio Corporation of America. Key to the speed of the device, according to RCA, is its high frequency capability by which the transistor is able to receive and pass on bits of information in the form of very fast electrical currents. The device is presently in the developmental stage, but it will be in commercial production soon.

LULU ASW WEAPON is an air-to-water atomic depth bomb called "the mightiest new anti-submarine weapon in the nation's arsenal," by General Mills, Inc. who developed the weapon jointly with the Naval Ordnance Laboratory. Although its performance capability is classified, the weapon is said to be capable of reaching out over a wide area to deliver killing underwater blows to enemy submarines. According to the Navy, the weapon is operational and ready for instant use.

COORDINATE CONVERSION COMPUTER was used to direct microwave antennas used for tracking at the Goldstone, Calif. site during the Project Echo experiments. Built by Computer Control Co., Inc., the computer determined the position of the balloon satellite and directed transmitting and receiving antennas by accepting pre-computed orbital data or on-line computation via teletype and correcting and converting it for the antenna systems.

ADVANCED HIGH POWER ACQUISITION RADAR recently developed by General Electric Co. is said to increase the defensive capabilities of the Nike-Hercules Weapons System, which is capable of detecting tracking and destroying any air-supported target. Designated Hipar, the new radar provides long range coverage on small, supersonic targets and supplies azimuth data so that the narrow beam target tracking radars can rapidly lock on high performance missile targets.

CHANCE VOUGHT CO. will operate the Project Mercury space capsule tracking station in the Hawaiian Islands, under a 15-month contract totalling $900,000 signed with the Pacific Missile Range acting for the National Aeronautics and Space Administration. The only such station in the Hawaiian area, the new facility is number 12 in a 17-station worldwide system established to track the manned satellites. Equipment at the Kohee Park facility on the island of Kauai will consist of an instrumentation radar system, a long-range tracking radar, command control transmitters, telemetry facilities, data transmission, communications facilities and auxiliary power units.

—GENERAL—

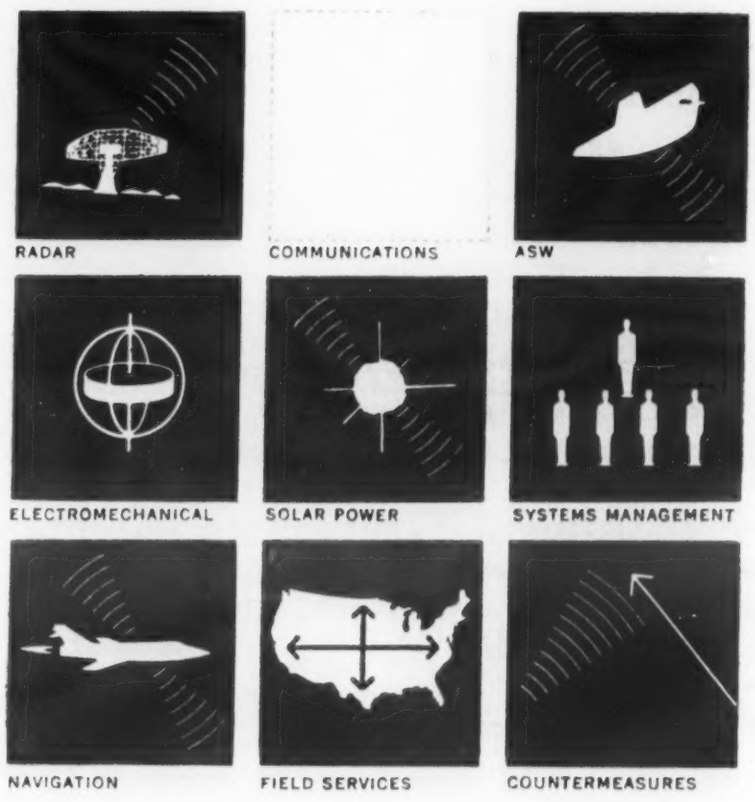
HIGH SPEED PHOTOGRAPHY CONGRESS to be held October 16-22 at the Sheraton Park Hotel in Washington, D. C. will present a survey of various fields of the sciences now using high speed photography as a basic tool in research and development and will explore new applications and techniques. The Society of Motion Picture and Television Engineers, which is sponsoring the congress, has received a $50,000 grant from the U.S. Army, Navy and Air Force to be used for the congress.

UHF-TV TESTS will be conducted to determine the feasibility of utilizing ultra high frequency channels to provide satisfactory television coverage to the New York City TV market area. The $3 million study, which was authorized by Congress at the request of the Federal Communications Commission, will be made during fiscal years 1961 and 1962. An advisory committee consisting of members from all groups interested in the TV industry will assist in the study. (*Continued on page 40*)

Hoffman

communications problems?

If an enemy should stage a surprise attack against the United States, our survival could depend on fast, reliable communications with command posts around the world. Hoffman has been a leader in the development and production of specialized communications equipment since the early days of World War II. Today, it is making significant contributions to some of the most advanced global communications systems employed by our military forces. With this experience, Hoffman stands ready to offer solutions to your communications problems.



Hoffman / ELECTRONICS CORPORATION

Military Products Division

3740 S. Grand Avenue, Los Angeles 7, California

Significant developments at Hoffman have created positions for scientists and engineers of high calibre. Please address inquiries to Vice President, Engineering.

QUALIFICATION TEST DATA on electron tubes and crystal rectifiers is available from the Armed Services Electro-Standards Agency, Fort Monmouth, N. J. Interested manufacturers can contact the agency for specific information on the submission of these products for qualification testing and approval.

HIGH RESOLUTION SCANNING ANTENNA may provide science with a new tool for experimental studies of the ionosphere. Without benefit of electric or mechanical moving parts, it scans a 42-degree azimuthal arc and can determine immediately the direction of radio signals received from a "forward scatter" transmission. The antenna was developed by the National Bureau of Standards.

CLOSED-CIRCUIT TV SYSTEM has been set up in the Virgin Islands by Entron, Inc. of Bladensburg, Md. The first such system to be installed in the Virgin Islands, this system began operation last month with five video channels and two FM music frequencies. The Virgin Isle TV Cable Corp., which is operating the system, has approximately 500 subscribers who pay a monthly fee to view films and kinescopes provided by the National Broadcasting Co., the Columbia Broadcasting System and ZIV International. News programs are serviced by United Press International.

ELECTRONIC LANGUAGE LABORATORY FACILITIES are being used in Michigan public high schools to train students to speak and understand a spoken language. Prior to the opening of school, one hundred fifty foreign language teachers convened at five separate but concurrent workshops which were set up to train them in the use of the newly installed electronic language equipment. The training costs of the workshops were jointly underwritten by two commercial firms, Magnetic Recording Industries, a division of Thompson Ramo Wooldridge Inc., manufacturers of equipment, and Howard and Smith, Inc., Detroit educational equipment distributing firm.

NEW BRITISH ELECTRONICS NEWSPAPER began publication last month. ELECTRONICS WEEKLY, published by Drury House in London, will deal "authoritatively" with national electronic news and will present news of developments overseas, according to the paper's circulation manager, S. W. Bunce. The newspaper carries general news and news in specialized areas of electronics.

PHOTOGRAPHY IN SPACE EXPLORATION will be discussed at the Industrial Film and Audio-Visual Exhibition being held October 10-13 in New York City. A presentation of the relationship and importance of photography to missile and space exploration programs will include discussions on the use of the camera as a research instrument and on the role of color photography in space probes.

WORLD-WIDE DATA TRANSMISSION NETWORK may be established at some future date. The possibility of such a network will be discussed at an International Telegraph and Telephone Consultative Committee (CCITT) meeting to be held in New Delhi, India, in November. At a recent meeting of the Data Transmission Subcommittee of the CCITT, it was decided that world-wide tests be conducted to recommend specific feasible standards for speeds to be expected of a data transmission network. Further details will be explored at next month's meeting.

TELEPHONES IN U.S. may increase approximately 4.9 percent over 1959 by the end of 1960, according to a midyear statement issued by the Business and Defense Services Administration. The number of telephones increased more than 1,650,000 during the first 6 months of this year. If this trend continues, the total number of telephones in the United States will be 74,000,000 by the end of the year.

BELL LABS SCIENTISTS carried on a coast-to-coast telephone conversation by bouncing their voices off the moon last August. As part of the preparation for the two-way telephone conversations conducted via the Echo balloon satellite, signals were beamed from the Bell Laboratories' installation at Holmdel, N. J., via the moon, to the Jet Propulsion Laboratory in Goldstone, Calif., August 3. The voice of William C. Jakes of Bell Labs was beamed from a 60-foot, dish-shaped antenna to the moon, some 240,000 miles away. Although the signal traveled at the speed of light, it took almost three seconds to complete the trip of nearly one-half million miles to Goldstone.

BRITISH EXPORTS OF COMMUNICATION EQUIPMENT TO U.S. in the first four months of this year totaled $638,000, a 45 percent increase over the same period of 1959. Navigation and radar equipment is included in this increase, which was announced by the Business and Defense Services Administration of the Commerce Department.

CALENDAR OF EVENTS

OCTOBER 10-15: Reliability Training Conference, Lake Texoma Lodge, Okla.
OCTOBER 24-28: National Business Show, Coliseum, New York City.
OCTOBER 27-28: Electron Devices Meeting, Shoreham Hotel, Washington, D. C.
OCTOBER 30-NOVEMBER 2: Electronic Industries Association Radio Fall Meeting, Hotel Syracuse, Syracuse, N. Y.

precise time
and
constant frequency

by DR. WILLIAM MARKOWITZ
Director, Time-Service Division, U. S. Naval Observatory

MODERN DEVELOPMENTS in fields such as communications, electronics, and satellite tracking have brought on requirements for precision in time and frequency of an extremely high order. Present requirement for accuracy of timing in satellite tracking is 1 millisecond (0.001 sec.). The requirement for precision in frequency is of the order of one part in 10^{10}. Since the basic definition of frequency is in terms of time, it is apparent that time must be determined and disseminated with the highest accuracy possible to meet the requirements.

Research on the problems involved is carried out through the close cooperation of the U. S. Naval Observatory and the Naval Research Laboratory. The Naval Observatory makes astronomical observations for time, establishes systems of time, and maintains the accuracy of transmissions of time and frequency. The Naval Research Laboratory develops electronic equipment required for the transmission and monitoring of precise time and constant frequency.

The Naval Observatory is the only agency in the U. S. which determines time. The reason why the Navy began determining time is that it is essential for safe navigation. The Time Service of the Navy Department was founded in fact, if not in title, in 1830, when a Depot of Charts and Instruments was established by the Navy in Washington, D. C. An essential function was to determine time for rating naval chronometers.

The time thus determined was made available for use by the public as the art of signalling advanced. Beginning about 1844 a time ball was dropped at noon, daily, from the roof of the old Naval Observatory on Constitution Avenue. These visual signals could be observed from ships anchored nearby in the Potomac River, and were used to check their chronometers. Beginning in 1865, Naval Observatory Time has been distributed on a wide scale by the Western Union Telegraph Co.

The development of communications by radio led to increased accuracy of time signals. In 1904 the first time signal was sent from the Naval Radio Station at the Navy Yard, Boston, and by 1909 signals were being sent from 19 Naval Radio Stations. The range, in these prevacuum tube days, was only about 100 miles for each station. In 1913 the powerful station at Arlington, Virginia, NAA, began sending time signals.

At present, Naval Observatory Time is transmitted by Naval Radio Stations NSS, Annapolis; NBA, Balboa; NPG, San Francisco; NPM, Hawaii, and NPN, Guam. These transmissions provide virtually world wide coverage for U. S. vessels. In addition, stations WWV and WWVH of the National Bureau of Standards broadcast Naval Observatory Time.

An important new development in time and frequency transmissions was the inauguration of time signals on VLF from the Naval Radio Station at Balboa in December 1959. The NBA carrier frequency of 18 kc/s is kept constant to about $\pm$ 1 part in 10^{10} by means of a very stable quartz-crystal oscillator. The quartz oscillator is regulated in accordance with atomic clocks of the cesium type. Through use of these VLF transmissions it is possible to calibrate frequency at a receiving site several thousand miles distant with a precision of about 1 part in 10^9 to 1 part in 10^{10} within a few hours. Time pulses are broadcast continually. The schedule of transmissions at the beginning of 1960 was 1300 to 2100 G.M.T., Monday through Friday. The schedule will be increased to 24 hours daily, except for maintenance, as the need for the signals increases.

The Navy VLF transmitters at Annapolis; Hawaii; Jim Creek, Washington, and Cutler, Maine, will also be stabilized in frequency to provide greater world-wide coverage.

To obtain high accuracy, time signals originate from clocks located at the transmitter sites. The signals are monitored by the Naval Observatory at Washington and its substation at Richmond, Florida, using equipment developed by the Naval Research Laboratory. The accuracy of this equipment is so high that a constant check on the running of the clocks at the transmitters can be maintained at Washington. Messages are sent from the Naval Observatory to regulate the running of any clock, as is necessary. To illustrate the degree of fineness involved, the total change in rate of the clock at NBA which is made in response to a message is one hundred-thousandth of a second per day.

In addition to controlling time transmissions the Naval Observatory must make the basic astronomical determination of time, or rather, *times*. The Naval Observatory issues corrections to seven kinds of time. Why would not one kind of time be sufficient, one might ask? The answer is that there are needs for different kinds of times in navigation, astronomy, geodesy, satellite tracking, and in physics. It would be no more feasible to carry out all scientific and technical projects with only one kind of time than it would be to utilize a single type of vacuum tube for all purposes in electronics.

The rotation of the earth is the basis for Universal Time (G.M.T.) in three forms, called UT0, UT1 and UT2. The differences between the three can be nearly 0.1 second. The rotation of the earth also is the basis for true sidereal time and mean sidereal time. The difference between these two can be about 1 second. Universal and sidereal times are determined by the Naval Observatory with an instrument called the photographic zenith tube (PZT). One is located at Washington, D. C. and another at the substation at Richmond, Florida, near Miami. The PZT was developed in 1934 for determining time, at Washington, and since 1951 has been adopted by a number of foreign observatories.

The rotation of the earth about its axis is not strictly uniform, so that the five kinds of time described are not uniform. Uniform astronomical time, called Ephemeris Time, is defined by the orbital motion of the earth about the sun. It is obtained in practice from the orbital motion of the moon about the earth. In February 1960, Ephemeris Time was about 32 seconds more advanced than Universal Time. Observations for Ephemeris Time are made at

the Naval Observatory with an instrument called the dual-rate moon position camera.

The prototype unit of time until October 1956 was the second of mean solar time. This unit is slightly variable because of changes in the speed of rotation of the earth, and in 1956 the International Committee of Weights and Measures redefined the second so as to be identical with the second of Ephemeris Time. The definition adopted is as follows:

"The second is the fraction 1/31,556,925.9747 of the tropical year for 12^h E.T. of January 0, 1900."

In 1955 the first highly precise atomic frequency standard, of the cesium beam type, was constructed at the National Physical Laboratory, Teddington, England. A joint program was started with the Naval Observatory to determine the frequency of this standard in terms of the second as determined with the moon camera at Washington. This was accomplished with the aid of time signals. The value of the frequency of cesium was found to be 9,192,631,770 cycles per second.

Beginning 1 January 1959 the Naval Observatory introduced a system of atomic time, called A.1 which is based on this frequency. Observations of the moon are continuing in order to obtain a more accurate value of the absolute frequency of cesium and of other atomic standards.

The tracking of artificial satellites provides a good example of how time systems are employed. A satellite which is in orbit within a few hundred miles above the surface of the earth is moving about 25,000 feet per second. An error of one millisecond in tracking will of itself produce an error of 25 feet. The motion of the satellite about the earth is best expressed in terms of atomic time, A.1. If the satellite is photographed against the background of stars then UT1 is required for obtaining the apparent celestial position. Hence, both A.1 and UT1 are required.

In practice, only UT2 is broadcast, and in effect G.M.T. is thus the same as UT2. The Naval Observatory issues corrections periodically which enable any of the six other kinds of time to be obtained from UT2.

The Navy is keeping abreast of requirements for precise time and constant frequency, not only for its own needs but for those of all technical, scientific, and civil agencies. Within the Navy a high grade of service is provided through close cooperation of Naval Communications, the Naval Observatory, and the Naval Research Laboratory. But cooperation does not stop here; the Navy is cooperating with other agencies in the U.S. and abroad in the conduct of experiments whose purpose is to improve still further the accuracies of time and frequency transmissions.

Command and Control

(*Continued from page* 37)

seat with respect to employment of modern weaponry.

The command and control effort, although growing rapidly, was in need of concentrated management effort. Actually, the Air Force had vested management of its complex electronic systems in a myriad of organizations that were basically black-box oriented and geographically dispersed—and this needed obvious rectification.

In a technical sense, the design and development of the command and control complex is no small challenge. It requires the finest systems-oriented technical talent our nation can muster. These factors contributed to the need for establishing the ARDC Command and Control Development Division to manage the entire command and control effort.

Hanscom Field was selected as the logical location of the new division for three reasons. In the first place, most of the ARDC operating units with major responsibilities in command and control systems research and development are located east of the Mississippi. Secondly, Hanscom has a maximum number of these activities—and electronic research and development has always been a predominant part of its effort. And finally, the Boston area provides a concentration of electronic talent.

As I discussed under "concurrency," there was need for an up-to-date command and control organization that would take the new knowledge gained by the total national research effort in electron technology and rapidly translate this knowledge into useful military systems. Efficient management of these systems depends not only on an effective management organization but upon day-to-day decisions in the vital technical, logistical and operational areas. The cumulative effect of these decisions in the long run really determines whether there is developed a useful and effective military system.

To insure proper inter-relationship of these decisions, there is required competent experienced personnel with an understanding of the technical, logistical and operational aspects of the problem. As I emphasized earlier, it is preferable in the interest of efficiency to locate these personnel in a concentrated team effort at one management location or complex. At the Hanscom Complex, this modus operandi will be exemplified by the co-located, joint operation of the ARDC's Air Force Command and Control Development Division, the AMC Electronic System Center, the Air Defense Command, and representatives of SAC, TAC, ATC, MATS, together with FAA and the RCAF.

C^2D^2 Organization

The C^2D^2 organization is quite clear and uncomplicated. Aside from the Command block (and the General and Special Staffs) there are two main operating directorates: Systems Management and Technology.

The Systems Management Directorate is in reality a grouping of 13 "L" Systems Project Offices. It is the directorate which manages and directs the command and control systems.

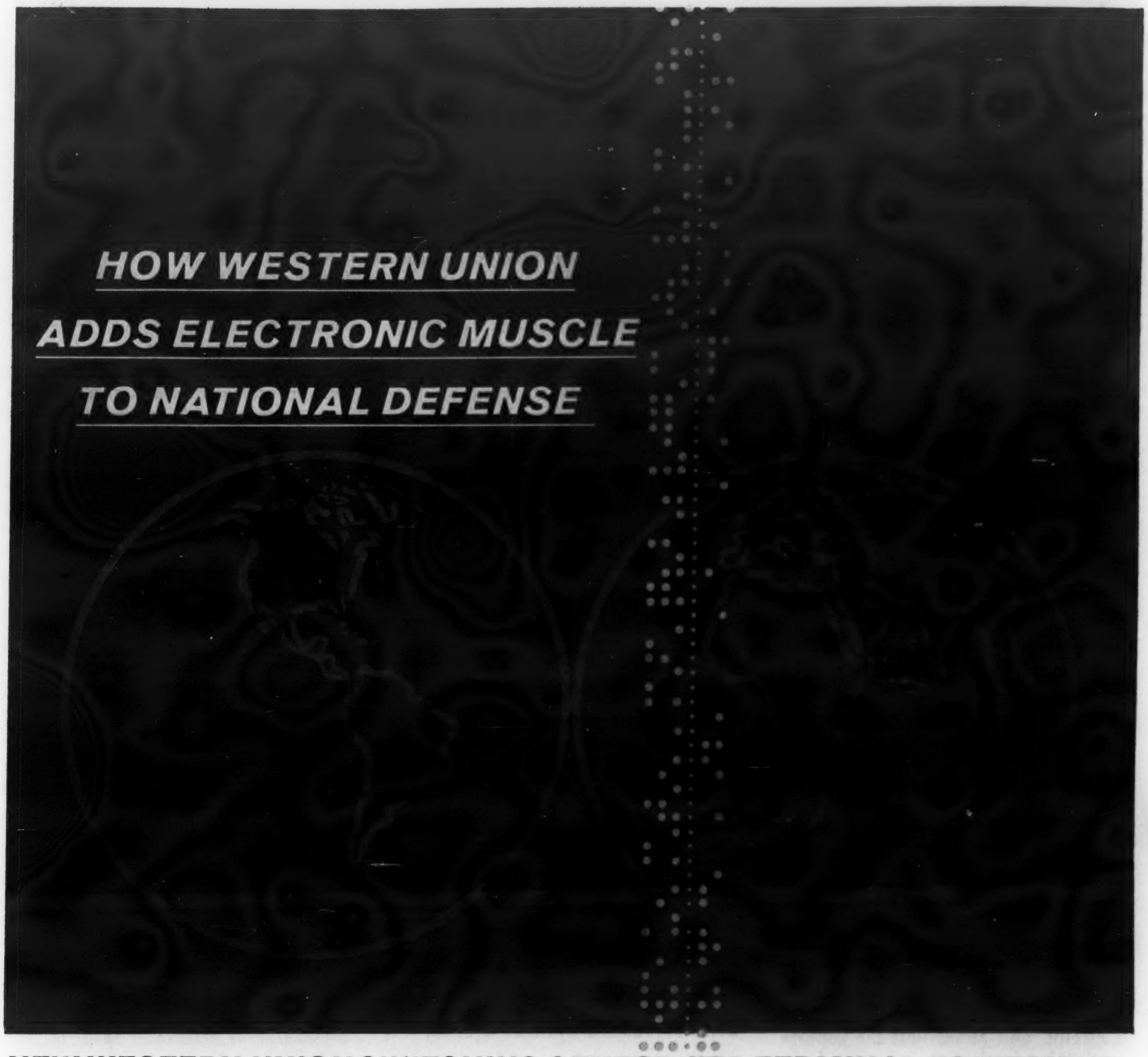
The Directorate of Technology has two functioning parts: Advanced Studies and Applied Research.

The Advanced Studies Division conducts those advanced studies leading to new and unique system capabilities, and provides a strong systems rallying point for the total efforts of the entire technology division.

The Applied Research Division does the research directly associated with the command and control mission. In addition, it sponsors the development effort which will create the building blocks for the "L" systems of the future.

AFC^2D^2 assumed command of the Rome Air Development Center. This Center will remain at Rome, New York, and will continue its scientific and engineering contributions to the total spectrum of communications-electronics research and development. The major application of effort will be in the early stages of research and development. Rome is a prime Applied Research Agency, concentrating on system support, advanced concepts, scientific experiments and applied research to determine feasibility.

C-square D-square is now operational with all 13 ESSPOs located at Hanscom and is dedicated to bringing into being the important command and control systems needed for Air Force operation in the Aerospace Age.



NEW WESTERN UNION SWITCHING CENTER AND TERMINAL EQUIPMENT LINKS OVER 350 AIR FORCE INSTALLATIONS AROUND THE WORLD!

Western Union's Plan 55 is the heart of the Air Force's Aircomnet-global Communications System. Operating out of ten major switching centers in the United States, Japan, Hawaii, England, Spain, and Germany—this 5½-million-mile automatic teleprinter system is compatible with other forms of military electronic communications. Minimum daily capacity is 130 million words, with speeds of up to 100 words per minute. Messages flash automatically and instantaneously . . . literally with the speed of light. The entire network is engineered to give urgent messages prime priority with continuous automatic checks to insure proper operation. This is but one of many ways Western Union keeps pace electronically with the ever-growing demand of National Defense. These Air Force Centers and other similar facilities operated by the military departments will become a part of the Defense Communications System (DCS) under the control and supervision of the Defense Communications Agency.

WESTERN UNION *. . . finds better ways to speed it electronically.*

weather services of the Federal Aviation Agency

F A A

by LOUIS L. DAVIS
Chief, High Speed Unit,
Communications Systems Branch,
Federal Aviation Agency

ONE OF THE many functions of the Federal Aviation Agency is the operation of national weather communication systems serving civil and military needs. While the FAA itself is a very new agency, many of its functions, particularly the weather services, have been provided for some thirty years by the Civil Aeronautics Administration, Civil Aeronautics Authority, Bureau of Air Commerce, the Lighthouse Service, and in the very early days, the Air Mail Service.

The present FAA weather communication system consists of three separate teletypewriter networks designated as Service A, C, and O, each of which plays its own role in contributing to the safety of air travel. The Service A network, serving some 2500 users, is composed of 12 circuits covering 48 states (excluding Alaska and Hawaii), connecting about 550 stations through over 40,000 miles of line. Our new States add many thousands of miles of cable, landlines, and radioteletypewriter circuits.

Service A is used for the collection and distribution of about 800 aviation weather reports hourly, plus various terminal forecasts, notices to airmen, and other related data. It is the most complex of the three and it carries the "freshest" or most current data, as a report is corrected in not more than twenty minutes when conditions change beyond certain established limits. Service A provides the continental flyer with current and expected weather conditions over the inhabited areas of the North American continent. Every FAA Air Traffic Communication Station has send/receive facilities on at least one Service A circuit, and about half the reports originating in the network are of observations made by FAA personnel at these Communication Stations. Essentially all FAA Air Traffic Communication Station personnel are, or were at one time, qualified Observers certificated by the Weather Bureau. For years, FAA personnel made observations at many airports now served by Weather Bureau offices.

The Service C network serves about 1000 users directly and millions indirectly through 6 circuits. The approximately 220 send/receive drops in Weather Bureau offices require about 24,000 miles of line.

The service handles a wide variety of data, principally synoptic; upper air conditions, radar reports, fall-out data and many general and specific types of forecasts; regional, crop, aviation and others. In all, there are over 40 types of data, though some of them are seasonal, appearing only in the winter months. It is probably safe to say that not only the aviation industry, but every person in the country makes use of Service C weather data in one way or another, though the great majority may never have heard of the service. Every television station, radio station, and every daily newspaper, all feature at least one weather report and one forecast daily which originated in the Service C network.

Most of the data collected consists of observations made every three hours or every six hours; some are made twice daily and some less frequently. Other reports used by the Weather Bureau in preparing synopses, forecasts, etc., come from many places; part-time observers in remote areas, ships on the Great Lakes, lighthouses, weather and other ships at sea, pilots in flight, industrial plants and military and airline offices.

The third network, Service O, is not as extensive inland as either of the other two, as it is devoted primarily to distributing weather reports and forecasts to and from overseas locations. The 6 landline circuits serve about 100 users in the States with data collected through about 25 FAA Air Traffic Communication Stations and International Air Traffic Communication Stations. Users of the Service are FAA, Weather Bureau, military offices and transoceanic air and surface carriers. The limited distribution does not detract from the importance of the data, however. Inland stations having drops on Service O are almost all air ports-of-entry and coastal stations are those serving international airports with International Air Traffic Communication Stations. Service O provides the international flyer with both Service A and Service C aviation data for international terminals.

International stations are maintained by FAA at New York, Miami, San Francisco, San Juan, Balboa, Anchorage, Honolulu, and on the islands of St. Croix in the Caribbean and Wake, Guam and Canton in the Pacific. Through these stations, FAA maintains circuits, mostly radioteletype, to Newfoundland, London, the Azores, Bermuda, Jamaica, Mexico City, several South and Central American countries, Australia, the Fiji Islands, the Philippines, and Japan. Through these circuits and through the World Meterological Organization weather reports are exchanged with those locations and with other countries in Europe, Northeast Africa and the Orient.

FAA maintains and operates World Meterological Organization stations at New York and Miami, broadcasting synoptic and forecast data by radioteletypewriter. The New York station broadcasts on 5 frequencies simultaneously; the Miami one on 4.

Another weather service of FAA is participation in a world-wide voice broadcast of aviation weather data. This is provided at New York on a time-sharing basis with Gander, (Newfoundland) Shannon and Paris. In the Pacific portion FAA Stations at San Francisco, Anchorage and Honolulu share time with stations at Tokyo and Hong Kong. The data carried consists of hourly reports and 12-hour terminal forecasts for selected international terminals and is provided especially for aircraft in flight.

At Miami, FAA operates a Caribbean meteorological radioteletype broadcast service, providing aviation weather data to anyone having radioteletype equipment in the Caribbean area. The service is in operation 24 hours a day with simultaneous transmissions on 5 frequencies during the daytime hours and on 4 frequencies at night.

The semi-hourly weather broadcast is an important part of the weather service provided by FAA. Almost 500 Air Traffic Communications Stations and Combined Station/Towers broadcast on one or more frequencies, and each reports the weather and other information of importance to pilots concerning that station and all other stations within a radius of up to four hundred miles. The broadcasts are made at 15 and 45 minutes after each hour, following the hourly

weather collection which is on the hour, and a "clean-up" collection of any new, special, or corrected reports at 40 minutes after the hour.

The 15-after broadcasts are of surface weather reports for up to a dozen stations within a radius of 150 miles. The 45-after broadcasts include reports of stations up to 400 miles away. Special broadcasts are made between these periods when sudden changes, such as line squalls, high winds or thunderstorms are likely to occur. These special warnings give the location of the disturbance and the direction in which it is moving.

Another weather broadcast service of FAA is now in its infancy. You will recall the promise of more about the low frequency ranges. Several of the ranges are now broadcasting transcribed weather data simultaneously with their range signals. In two or three years, it is expected that continuous transcribed weather broadcast will be in operation at almost 90 locations and will replace the half-hourly broadcasts at those locations.

Many persons besides pilots take advantage of this weather broadcast. Now that low frequency transistor radios are available and relatively inexpensive; boat owners, hunters, fishermen, or for that matter, anyone living near one of these stations can get current weather reports without delay, day or night.

Maps showing locations of the stations, their frequencies and call letters may be purchased from the U.S. Coast and Geodetic Survey, Washington, for twenty-five cents each. They are known as the World Aeronautical Series, and 43 of them cover the 48 states in areas of about 300 by 380 miles each.

Enroute Assistance

Another important weather service FAA provides is in connection with Flight Assistance Service at locations not served by Weather Bureau airport stations. In pre-flight pilot briefing, weather reports and forecast for the destination and for stations along the proposed route of flight are made available to the pilot and conditions affecting navigation facilities and landing fields enroute are brought to his attention. Enroute assistance is also provided by radio through FAA Air Traffic Communication Stations as previously mentioned and through Combined Station/Towers where FAA personnel perform the functions of both Flight Service Specialists and Tower Controllers.

For a number of years, and especially during the last few years the demands for aviation weather reports have increased by leaps and bounds. In the present Service A network, each of the 12 circuits serves a different area of the country. Each station delivers a weather report to the circuit serving the area at least once an hour. It is obvious that for only broadcast purposes many stations in each area must have reports from one, two, or more other areas. In fact, almost all reports originating in any area must be relayed to two or more other areas. Each circuit carries about three times as many reports from other areas than it collects from its own stations. Many circuits carry reports they do not need merely because the originating circuit does not have relay facilities with the destination circuit.

Model 28 Equipment

The first step in the improvement program is the replacement of the Model 15 line of teletypewriter equipment which has been in use about 20 years, with the Model 28 equipment. This provides many automatic functions and is capable of operating at a higher speed.

In order to meet the needs of the major subscribers for more distant weather data, which it is not desirable to put on the area circuits, 14 supplemental circuits will be added, each serving the general area served by one of the Area circuits, but carrying entirely different reports. The present adjacent-circuit relay system will be replaced with a new system, the Automatic Data Interchange System which will be commissioned at an operating speed of over 850 words per minute. The five locations connected by the red line will be interchange locations, each of which will serve three area circuits with send/receive facilities. The five ADIS Interchange Centers are San Francisco, Kansas City, Cleveland, Fort Worth, and Atlanta. The equipment at each of these locations will also serve three supplemental circuits and two local drops with send/receive facilities, and will deliver to any circuit, whether area, supplemental or local, only the reports it requires.

The other six locations are major forecast centers of the Weather Bureau, as are the five also, and are served with receive/only facilities on two local drops.

When the Automatic Data Interchange System, which we call ADIS, is commissioned, and present relay equipment decommissioned, the operating speed of the Area Circuits will be increased from 75 to 100 words per minute. Other new equipment, Automatic Program Units Low Speed, will, in response to signals from the ADIS control station, start sequence collections on all of the 15 area circuits simultaneously, control collections through selective calling, and will provide control codes and signal pulses to the ADIS system, in effect, telling it when reports are ready for entry.

The supplemental circuits will be commissioned at 100 words per minute since they are not dependent upon the relay equipment.

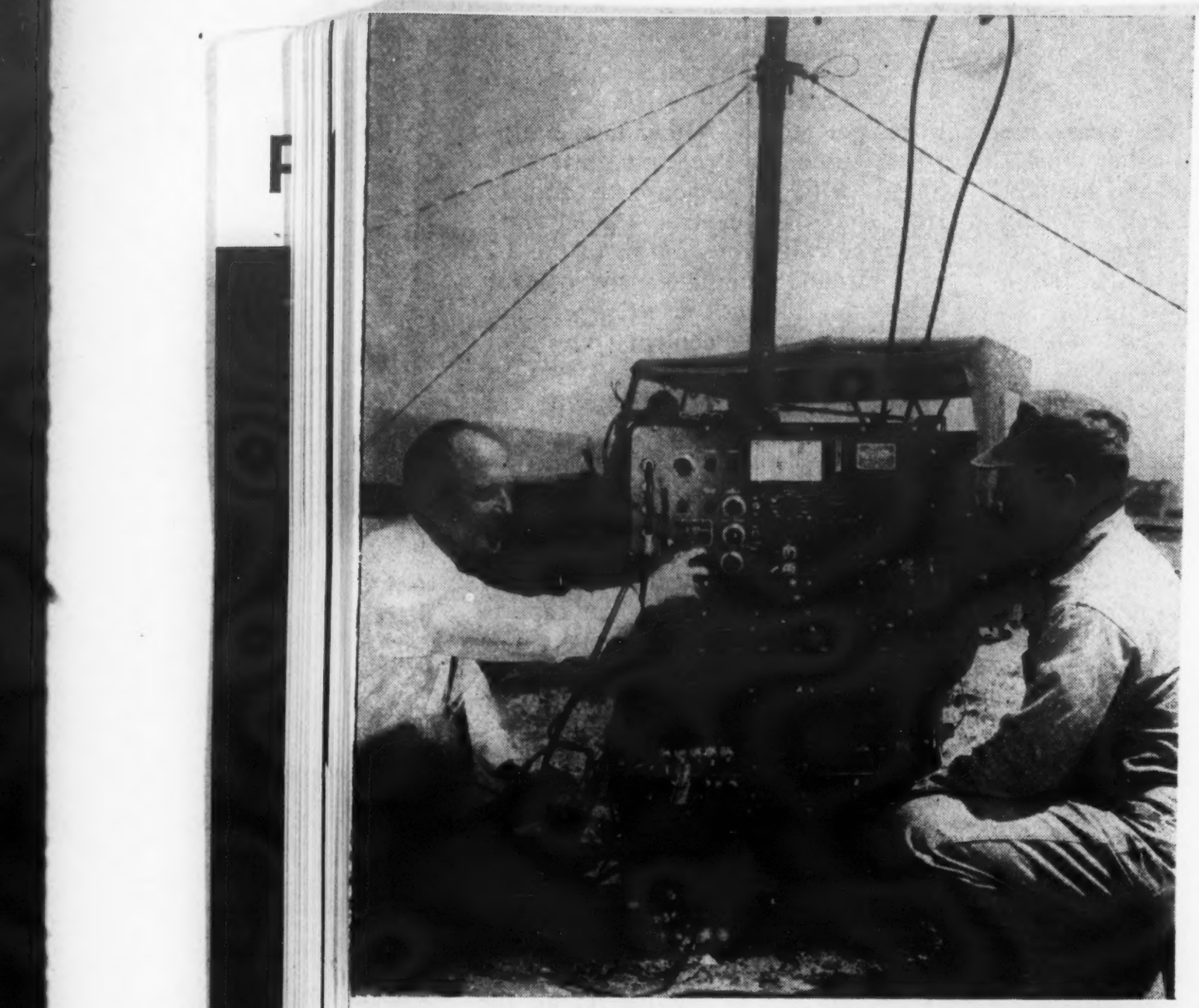
The ADIS equipment provides full freedom of selection in the reports delivered to its output circuits. It is capable of directing any one report or any pattern of reports to any or all of its output circuits. This is accomplished through recognition of the signature or identification characters of the originating station.

The equipment is programmed to recognize the 3 letter identifier of all United States stations transmitting to the Service A Network; all those which transmit to the Service C network, but not to Service A; all the 2-letter identifiers of the Canadian Weather Network; all the 3- and 4-letter Mexican stations whose reports enter Service A; all 2-, 3-, and 4-letter identifiers expected to be utilized in the foreseeable future; 40 numerical identifier codes; and provides facilities for adding 200 more identifiers or codes of up to 4 characters each for future expansion. In all, 1100 selection codes are available.

In addition to providing full freedom of selection, the ADIS equipment will also sort the selected reports into three channels for each area circuit, and into either of two channels for any supplemental circuit or local drop. When read out to the circuits, the reports of greatest urgency go first.

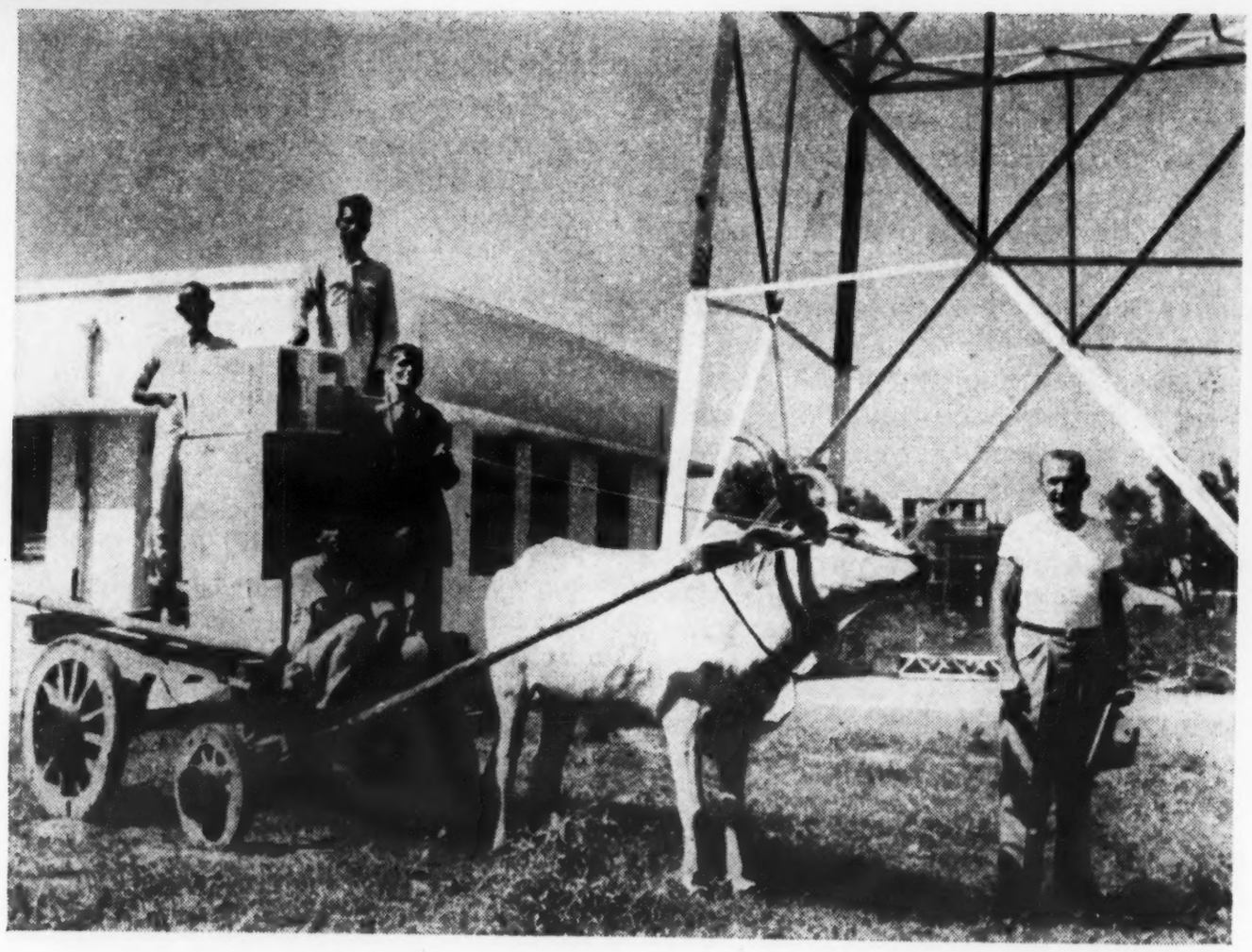
In order to provide the half-hourly weather broadcast essential to safe air navigation, it is necessary that each area circuit carry reports from several adjacent circuits. This arrangement leaves something to be desired by those offices requiring reports from a large area, however, as securing a drop on a second area circuit gives him only 25 to 35% more coverage than one circuit alone. The supplemental circuits are provided to improve the situation.

A user having drops on one area circuit and its associated supplemental circuit will then receive reports from about 500 locations, something like 60% of all the reports originated hourly in the United States, Canada, and Mexico.



Instructing Marine Corps personnel in portable microwave communications equipment, AN/TRC-27.

In Germany, checking a proposed radar site for masking objects, preparatory to installation.

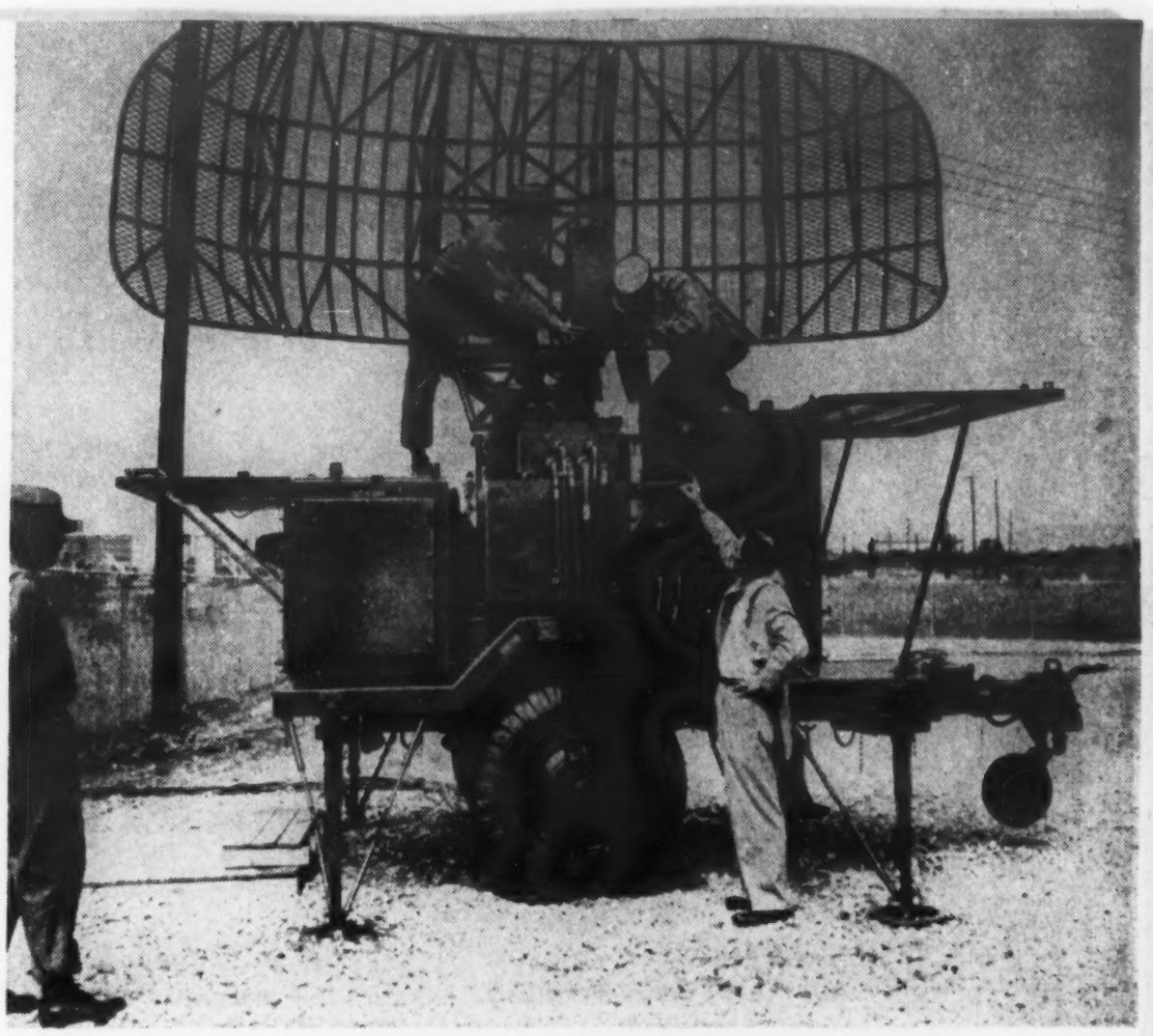


Delivering AN/CPS-9 weather radar parts for the Department of Meteorology, New Delhi, India.

Now in their 18th year of technical assistance t

Raytheon field engineers, in over 10

work on installation, instruction and maintenance



On-the-spot training in the field on part of the Hawk missile system.

About to board a B-47, this Raytheon field engineer provides technical assistance on electronic countermeasures equipment.

(U.S. Navy photo)

On Midway, Navy technicians receive instructions on adjustment of airborne navigational equipment.

ce he Armed Services and government agencies,

r 10cations in the United States and overseas,

ce lectronic equipment.

RAYTHEON COMPANY, WALTHAM, MASS.

RAYTHEON

EXCELLENCE IN ELECTRONICS

message processing—is it being overlooked by emphasis on message transmission techniques

by
REAR ADMIRAL BENJAMIN KATZ, USN (Ret.)
Technical Materiel Corp.

WHEN ONE READS any of the professional and business magazines in the electronics field or attends a communications-electronics convention and sees the exhibits displayed, he cannot fail to be impressed by the efforts and imagination of many firms, agencies, and individuals toward developing new techniques and equipments to improve message transmission. Scatter communications, moon relay, multichannel circuits, transoceanic cables, facsimile, and auotmatic switching are only a few of the methods devised to speed a message between two points.

Time Consuming Methods

But are we forgetting, or failing to realize, that at the start and end of each message we are still using processes which have been virtually unchanged since the advent of rapid electrical transmission? Before we can use any of our marvelous transmission techniques, each and every message which is to be sent from one person to another by teletypewriter transmission using 5 level tape must first be placed in proper communciation form, manually, and then be retyped, manually, to obtain the tape so that it can be sent. Both of these processes take time. When the message is received, it must again be processed manually for delivery to the action office; while this is not as difficult as preparing the outgoing message for transmission, nevertheless, time and human effort are again required. The greatest portion of time required for a message to pass from an originator to an addressee is taken up in their message centers; the actual transmission time between these centers is only a small percentage of the total time between the originator and the addressee. These manual processes virtually nullify the gains made in transmission speeds and capacity of circuits through our technological efforts.

Automatic Processing

It would appear that, in our electronic age, means could and should be developed to process messages automatically to reduce the time required and the human effort involved. The area that needs the greatest attention is in the preparation of outgoing messages, specifically the manual conversion of the titles of the originator and addressees to communication form and the retyping of the entire message to obtain the tape.

Without going into the details involved in message processing, as they are probably known to most readers, some ideas for accomplishing the above are offered. First, it is possible to obtain a tape of the message at the same time it is first typed in the office where it is prepared. (If the message is changed before being released, the original tape may no longer be usable. In this case, the message could be retyped at a suitable central point.) Tape producing electric typewriters or teletype machines are available commercially for this purpose. After release the message can be transmitted electrically to the message center, where it will be placed in communication form. Another method is to transmit the message by facsimile from the office of the originator to his message center, but while this will reduce the time required between these points, it will still have to be retyped in the message center to obtain the tape for transmission. Another means is to use an optical scanner in the message center to convert a typewritten page to tape.

The above possibilities could offer relief from the manual retyping of messages in the message center, but one final means must be provided, and that is to convert the titles of the originator and addressees into communication indicators to permit message routing and handling. This is the longest and most tedious process, especially when there are many addressees. For this conversion, an electronic processing machine which will match the titles with their indicators should be developed.

Improved Speed

Without doubt, any of the machines described will cost money, but this cost should be weighed against the improved speed of service to be gained. It can also be said that a few more persons can be placed in the message center to help process messages. But is this what we want in this modern age of high speed jets and missiles? Do we want to provide virtually instantaneous communication between any two message centers but still handle messages in them manually? Do we want to keep human beings working in areas which are adaptable to the use of machine techniques?

If the answers to the above questions are yes, then let us continue to handle messages in message centers as we have been doing. If the answers are no, then with our technological capability and know-how cannot our machine techniques be developed to replace the manual and time consuming processes used in message handling and, at the same time, provide service in the message centers which is commensurate with the rapid transmission time between them?

WHAT'S BEHIND A BMEWS RADAR?

Years of experience—for as early as 1954, General Electric had conceived and developed radar equipment capable of detecting ballistic missiles at 1,000 miles. This was the forerunner of the AN/FPS-50 surveillance radar being provided by General Electric under subcontract to RCA for the Air Force Ballistic Missile Early Warning System (BMEWS).

The AN/FPS-50 radar equipment, with a range in excess of 2,000 miles, is a singular example of achievement in defense electronics. It is another milestone in General Electric's sustained engineering effort to develop and produce equipment to meet the unprecedented detection problems posed by ICBM's. 176-01

Progress Is Our Most Important Product

GENERAL ELECTRIC

DEFENSE ELECTRONICS DIVISION
HEAVY MILITARY ELECTRONICS DEPARTMENT
SYRACUSE, NEW YORK

report from

WESCON

SIGNAL Staff

THE INTEREST GENERATED by electronics in the western part of the United States was well illustrated by the Wescon Show held at the Los Angeles Sports Arena during the latter part of August. As the first trade show held at the Sports Arena since its completion and the largest business gathering to be held in Los Angeles during 1960, Wescon had a registration exceeding 40,000 over the four day period. It was co-sponsored by the Institute of Radio Engineers and the Western Electronic Manufacturers Association.

The technical sessions were distinguished by a number of papers on timely subjects and by tailoring the type of session to the subject being discussed. Particularly impressive were the panel sessions that encouraged audience participation. In addition, four round-table discussions were held on a subject that has recently become important, man-machine systems.

The relationship between man and machine was the subject of more sessions than any other. John M. Salzer of Ramo-Wooldridge broke the operation of the human mind into four parts, perception, memory and recall, processing and cerebration. Perception, the process of distinguishing one sound or image from another, is very hard to automate. Memory and recall has been partially automated but little progress has been made in increasing the associative powers of the machine. The processing function can be reduced to arithmetic operations and almost completely automated. Cerebration, or involved reasoning, is very hard to pin down; extensive automation in this area is unlikely in the forseeable future. Dr. Salzer concluded that man is definitely not outmoded and will continue to play a vital role in man-machine systems.

A session that examined the value of the technical symposium was of particular interest to those attending or participating in symposiums frequently. Symposiums were examined from the point of view of the speaker, writer, editor, and publisher. In his discussion of the speaker, Irving J. Fong of Remington Rand Univac illustrated how much more effective a talk could be if not read from a paper but extemporaneously given about the paper. Mr. Fong described Univac's plan for assisting their engineers in the preparation of speeches and papers. Neil J. Horgan of the Rand Corporation stressed publication of papers before a symposium, so that those attending could have read each paper before the talk. The talk and the ensuing discussion should then be summarized for distribution to the attendees after the symposium. All participants in this session stressed the importance of having a worthwhile contribution before a paper or talk is prepared.

The person who invests in electronics is investing in technology, according to R. T. Silberman, Executive Vice President of Electronic Capital Corporation. Mr. Silberman cited the price/earnings ratios and the market value/capital assets ratios of electronics firms to substantiate his view that the investor has consistently paid a high price for technology and growth. His company provides capital for electronics firms in transition between proprietary ownership and public ownership. One of the most important criteria for Electronic Capital Corporation's investing in a company is that the company must have a timed technical advantage; that is, not only have an advantage in technical know-how but be able to exploit this know-how before someone else does.

David Packard, president of Hewlett Packard delivered the address at the WEMA corporate luncheon. He compared education and electronics in Russia and the United States and concluded that the U. S. is ahead. Mr. Packard advocated a vigorous national policy and said that a healthy electronics industry would continue to aid in keeping the United States strong. The fact that the atmosphere in the West is conducive to the exchange of ideas and talents has contributed to the spectacular growth of the electronics industry in the West, according to Mr. Packard.

"Salt Water Electronics" was the title of a talk by RAdm. J. A. Jaap of the Office of the Chief of Naval Operations. Adm. Jaap stressed the environmental problems faced by ship board electronic equipment. High humidity and salt spray make packaging a major problem. Space is at a premium and equipment must be designed to prevent mutual interference. Adm. Jaap called on the electronics industry to provide the equipment to carry out its mission in modern warfare.

Another feature of the event was Wescon's Future Engineers Show; thirty high school students participated. Designed to stimulate interest in electronics on the high school level, the show featured exhibit's illustrating the projects that won the thirty students the privilege of competing for the $1000 DeForest Scholarship Award. The winner of this year's award was Dwight Jaeger, 17, for his experiment which simulates the gravitation pull of satellites as they orbit around the earth.

A total of 987 exhibits of electronic and related equipment were shown at Wescon. The quantity and diversity of these exhibits do not permit a report in this issue. However, manufacturers introduced many new products some of which are described in "News Items and New Products." (page 68)

BURGOYNE IGNORES RECONNAISSANCE AND INVITES DISASTER

General "Gentleman" John Burgoyne was not one to fret over reconnaissance.

Saratoga, frequently called the turning point of the American Revolution, was the end product of a series of "no reconnaissance" battles fatal to Burgoyne's invasion force. Supremely confident as he swung southward from Canada, the British commander rarely knew where or what was ahead. St. Leger's British force, vital element in Burgoyne's campaign, disintegrated when its sizable Indian contingent vanished at news of a huge American counter force. Reconnaissance would have readily shown the Americans mustered a mere 1,000 men. Along his march, Burgoyne dispatched his grenadiers to reinforce a Hessian advance unit at Bennington . . . as usual, without adequate reconnaissance. The grenadiers did not discover until after they were decimated by a Colonial force that the Hessians had already been wiped out. Finally, Burgoyne's confused and weakened men, alone and completely ignorant of enemy forces, surrendered at Saratoga.

Throughout the history of warfare, successful field commanders have based command decisions on proper reconnaissance. Burgoyne ignored history and the obvious need for strategic and battlefield reconnaissance thus committing a series of faulty command decisions and helping to assure the success of the American Revolution.

From the beginnings of communities on the face of the earth, reconnaissance has helped shape history. Today CAI's specialty in this area is helping shape history to the advantage of the Free World. Typical of CAI contributions are: **V.I.P.** Visual Integrated Presentation, data display system; **KA-30** the world's most versatile aerial camera; **SOLO** the only electro-optical "available now" guidance system.

CAI

CHICAGO AERIAL INDUSTRIES, INC.

550 WEST NORTHWEST HIGHWAY, BARRINGTON, ILLINOIS • offices: DAYTON, LOS ANGELES, WASHINGTON, D.C.

OTHER DIVISIONS: KINTRONIC, CHICAGO AERIAL SURVEY, Franklin Park, Illinois; PACIFIC OPTICAL CORP., Inglewood, Calif.

WHAT WOULD THESE MEN *say about the AFCEA Convention? They probably would say that the AFCEA Convention provides an important audience because it is held in Washington, D. C., and is attended by leaders in military and industry; that the latest communications and electronic equipment is displayed by industry giving a preview of important technological advancements; that the AFCEA Convention provides top-notch speakers presenting their views on timely subjects relating to communications, electronics and photography. The 15th annual AFCEA Convention to be held June 6, 7 and 8, 1961 at the Sheraton-Park Hotel will be the largest ever in 1961 and the largest electronics show in the Nation's capital.*

ALDEN SCANNERS MARK NEW ERA IN FACSIMILE COMMUNICATIONS

Compact, mobile Alden Flat Copy Scanners are in use today throughout the U. S. Weather Bureau Hi-Altitude Facsimile Network — marking a bright new era of simplified, continuous facsimile communication. And here are the reasons why —

NEW INSTALLATION SIMPLICITY . . . within two hours of air delivery, Alden Scanners at the Hi-Altitude Network were uncrated from their fold-away shipping cases, rolled in, plugged in, and *fully tested* for 60, 90, and 120 RPM quiet and dependable operation.

NEW COPY HANDLING SIMPLICITY . . . map transmission is no longer dependent on exact drum mounting. With Alden's expandable copy feed head, maps of *any width or length* can be scanned, one after the other, fed straight or crooked, *with only one Alden Scanner.* Original plotted maps can now be scanned without cutting to size. Map plotters have originals returned in half the time. Space and maintenance problems are minimized.

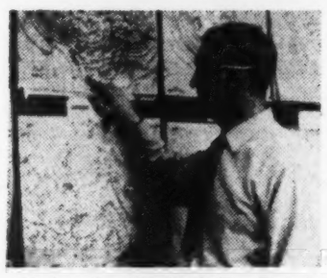
NEW CLARITY — NEW SHARPNESS . . . with copy feed rolls precisely positioning surface of the map on the flat copy scanner table, exact focal lengths are maintained for clear, sharp recordings. Focus smudge caused by unusually thick copy or copy lifting from drum is *completely eliminated.*

MEETS ALL FUTURE REQUIREMENTS . . . the practical scanning equipment for a world-wide facsimile map network. Speeds can be easily increased — without reengineering of equipment — for use with coaxial or microwave transmission facilities and computer-processed weather data.

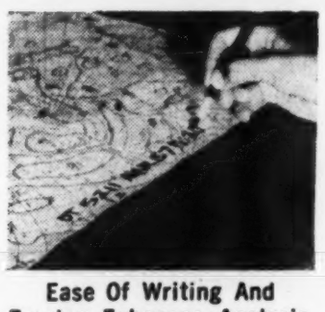
WHAT ARE YOUR FACSIMILE REQUIREMENTS? LET'S GET TOGETHER . . . Alden Flat Copy Scanners and Recorders are available in all sizes (and up to 30 times present network speed) to users and qualified manufacturers. Your inquiry is invited.

HERE'S WHY FORECASTERS PREFER* ALDEN RECORDERS AND ALFAX MAPS AND WHY WE THINK YOU'LL LIKE THEM TOO!

MOST COMMENDED FEATURES OF ALFAX MAPS



Color Is Easiest To Read Under All Lighting Conditions



Ease Of Writing And Erasing Enhances Analysis

Clean Crisp Duplicates By Bruning Or Ozalid

PLUS THESE UNIQUE FEATURES

LOW COST . . . Alfax papers save ⅓ to ⅔ yearly paper costs.

CLEAN . . . Electricity is the Ink . . . ion deposits make crisp brown marks on clean white background — free from dust, smudge and chemical irritants.

PERMANENCE . . . Alfax stores indefinitely . . . recording marks are permanent.

* In surveys of weather forecasters experienced with all weather facsimile systems, 3 out of 4 indicated a marked preference for Alden Recorders and Alfax Maps.

MOST COMMENDED FEATURES OF ALDEN RECORDERS

EASE OF INSTALLATION
Compact, mobile, and ready for immediate operation.

Uncrate

Roll in

EASE OF OPERATION
A new high in clean, quiet, trouble-free operation

Instant Visibility

Easy Paper Loading

Automatic Time-Clock Programming

EASE OF MAINTENANCE

Front panel checks

Back connector checks

Plug-in construction

PLUS THESE UNIQUE FEATURES

SECURITY . . . Low voltage marking process does not generate a signal that can be intercepted.

HIGH SPEEDS . . . Sixty, 90 or 120 RPM operation — recorder technique and paper capable of 15 times these existing speeds.

VOLUME PRODUCTION . . . Designed for volume production on short lead time through unique expandable manufacturing processes.

CEILOMETER BREAKTHROUGH

Used with rotating beam ceilometer, Alfax paper and Alden recording techniques replace continuous live scope observation with a continuous pictorial history of cloud conditions. Dynamic tone-shade gradients in warm color reveal all pertinent ceiling information in easy-to-read, easy-to-interpret form. Superimposed dark maximum signal marking shows exact reportable cloud height.

ALDEN ELECTRONIC AND IMPULSE RECORDING EQUIPMENT CO., INC.
Alden Research Center — **Westboro, Mass.**

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Paul S. Mirabito
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1962

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Joseph E. Heinrich
John R. Howland*
Fred E. Moran
Donald C. Power
Stephen H. Simpson

1963

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A. F. Cassevant
Walter C. Hasselhorn
Walter P. Marshall
Henry J. McDonald
A. L. Pachynski
William L. Roberts
Ellery W. Stone

1964

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W. Preston Corderman
E. U. DaParma
George L. Haller
Charles F. Horne
David R. Hull
John W. Inwood
Walter K. MacAdam

**Executive Committee Member.*

Association affairs

Roy E. Meyers (left), AFCEA Regional Vice President, receives a special Edison Radio Amateur Award citation from B. S. Angwin, Los Angeles area sales manager for General Electric. He was cited for his operation of amateur radio service during last year's Ninth Plenary Assembly of the Consultative Committee on International Radio (CCIR) in Los Angeles.

Ray E. Meyers Honored

Ray E. Meyers, AFCEA Regional Vice President was recently honored with a special Edison Radio Amateur Award citation in a program conducted by the General Electric Company. The citation plaque was presented at a ceremony during the Western Electronic Show and Convention in Los Angeles, August 23-26.

The citation reads: "For promoting international good will through his skillful planning, organizing, establishing and operation of extensive worldwide radio communications during the Ninth Plenary Assembly of the Consultative Committee on International Radio (CCIR) held in Los Angeles in April, 1959. The special radio station handled more than ten thousand important communications during the conference."

Herbert Hoover, Jr., operator of station W6ZH, Palo Alto, was one of the radio amateurs who worked with Mr. Meyers last year in setting up radio service for the world convention delegates.

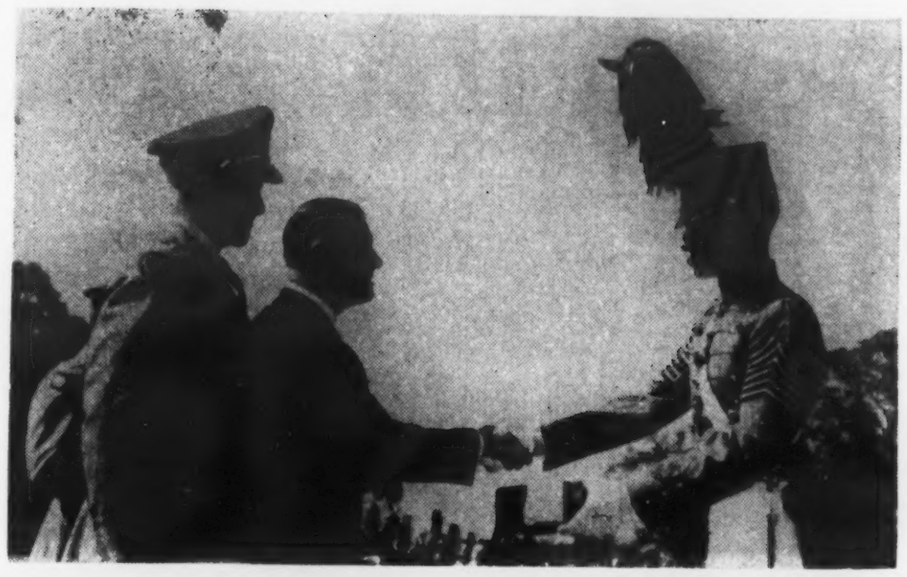
A special act of Congress was required to permit foreign "hams" to send amateur radio messages within the scope of communications service directed by Ray at the CCIR meeting. A special confirmation card was printed bearing a message from President Eisenhower which read: "Greetings—on behalf of the 185,000 amateur radio operators in the United States and its territories, please accept my personal thanks for contacting our special events radio station K6USA. Dwight D. Eisenhower, President of the United States."

Approximately 10,000 contacts were made by the station with amateur radio operators in about 100 foreign countries during the month-long 24-hours-a-day operation of station K6USA by both American and foreign amateurs attending the session.

Mr. Meyers is director of the Southwest region of the American Radio Relay League, in addition to his many extracurricular activities including his time consuming work for AFCEA and his home community. He operates amateur radio station W6MLZ at his home in San Gabriel, California.

A retired Navy lieutenant commander, he was awarded the International Gold Medal of the Veteran Wireless Operators' Association in 1931 for his work aboard the first Nautilus submarine to sail under the Arctic ice pack. While the sub was listing badly in the North Atlantic and without battery power, Ray used an emergency receiver as an oscillator, tuned it to 500 ksc and taped out an S0S on the antenna. His message, which saved the crew, was heard 28 miles away. The story of this daring adventure was reported in the October, 1958 issue of SIGNAL.

Academy Awards



AFCEA Academy Awards this year consisted of portable transistor radios donated by Packard-Bell Electronics Corp.

Benjamin H. Oliver, Jr., National President, is shown presenting the award to West Point Cadet C. P. Otstott for the highest average in electrical engineering.

Annapolis Midshipman Larry Lamont Phemister receives his award from AFCEA Vice President Rear Admiral Frank Virden, USN, Assistant Chief of Naval Operations (Communications)/Director, Naval Communications.

The award to Air Force Cadet David B. Luce was presented by AFCEA Vice President Major General Harold W. Grant, USAF, Director, Communications-Electronics.

Coast Guard Cadet Herman Freese, Jr., is awarded his transistor radio by AFCEA Regional Vice President G. D. Montgomery, Long Lines Department, American Telephone and Telegraph Company.

Loral Electronics New Group Member

Loral Electronics Corporation, manufacturer of electronic products has become a group member of the Association. Emanuel M. Siegel, vice president, Contracts and Customer Relations, will act as company representative.

Those named to membership by the company are: Leon Alpert, president; E. J. Garrett, vice president, general manager; E. M. Siegel, vice president, Contracts and Customer Relations; B. Garrett, vice president, Engineering and Research; R. C. Amidon, engineering representative; M. L. Rosen, Market Research; A. G. Marlin, vice president, manager, Washington Regional Office; H. Martin, engineering representative; D. Maltz, engineering representative; A. D. Metsch, assistant manager, Contracts and Customer Relations.

George W. Bailey Honored at Testimonial

Dr. George W. Bailey, executive secretary of the Institute of Radio Engineers and former president of the American Radio League, will be honored at a testimonial dinner by the Single Sideband Amateur Radio Association and the Quarter Century Wireless Association. This affair, marking the opening of the Hudson Division ARRL Convention, will be held at the Shelburne Hotel, New York City, on October 14th.

Dr. Bailey is a past president of AFCEA and a permanent member of the Board of Directors.

Two AFCEA Directors Take New Posts

David R. Hull has been elected corporate vice president of Hoffman Electronics Corporation and Paul S. Mirabito has been promoted to vice president, Defense Contracts Organization of Burroughs Corporation. Both Mr. Hull and Mr. Mirabito are national directors of the Association.

In his newly-created position, Mr. Hull will initially have direct responsibility for the operation of Hoffman's Military Products Division and coordination of activities of the company's Santa Barbara, Calif., Science Center with other corporate divisions. Prior to his new position he was vice president and general manager of Equipment Operations for Raytheon Company for ten years.

From 1925 to 1948 Mr. Hull served as an officer in the U. S. Navy, retiring with the rank of captain. He then joined International Telephone and Telegraph Corporation.

Paul S. Mirabito will be responsible for the sales, contractural relationship and field service of Burroughs Corporation in his promotion to vice president in charge of the company's Defense Contracts Organization. His prior assignments were controller of Contro Instrument Company, a Burroughs subsidiary in Brooklyn, N. Y., and assistant corporate controller.

(*Continued on page* 57)

ROTC AWARDS 1960

The Association takes great pleasure in announcing the names of the winners of the Armed Forces Communications and Electronics Association Gold Medal Honor Awards. These medals are awarded annually to outstanding senior Army ROTC, Navy ROTC, and Air Force ROTC students majoring in Electrical Engineering. Selection is made by the Military Staff and the Dean of Engineering of the respective university or college. Some of the criteria for selection include proficiency in education and leadership, moral character, and participation in recognized campus activities—all to a high degree.

In addition to the Gold Medal, the award includes a certificate, a year's membership in AFCEA, and a subscription to SIGNAL *Magazine, the official journal of the Association.*

A. & M. College of Texas
William Bernard Heye, Jr., *Air Force*
Auburn University
Jack Andrew Cumbee, Jr., *Air Force*
Bowdoin College
George W. Dean, *Army*
Bucknell University
James Peter Chapman, *Army*
California State Polytechnic College
Ronald G. Reich, *Army*
The Citadel
Charles H. Neubauer, *Air Force*
Clarkson College of Technology
George S. Mayo, *Army*
Clemson Agricultural College
George P. Crotwell, Jr., *Air Force*
Colorado State University
Gary E. Lovell, *Army*
Carl D. Petersen, *Air Force*
Cornell University
Stephen M. Golder, *Army*
James B. Fraser, *Air Force*
Robert J. Loane, *Navy*
Dartmouth College
John Rogers Wheaton, *Army*
Drexel Institute of Technology
Bennett S. Lebow, *Army*
Evansville College
John P. Joyce, *Air Force*
Gannon College
Albert J. Montevecchio, *Army*
Georgia Institute of Technology
James R. Helton, *Army*
Howard L. McKinley, Jr., *Air Force*
Norman Carroll Koon, *Navy*
George Washington University
Arthur W. Brooks, Jr., *Air Force*
Howard University
Vernon O. Drew, *Air Force*
Illinois Institute of Technology
George William Berg, Jr., *Navy*
Iowa State College of A. & MA.
Thomas J. Pedersen, *Army*
Harold K. Ressler, Air Force
Kansas State University
Loren W. Conrad, *Air Force*
Lowell Technological Institute
Rene A. Gaillardetz, *Air Force*
Loyola University of Los Angeles
Robert E. Lowe, *Air Force*
Marquette University
Alfred J. Heyer, *Army*
Robert G. Hoch, Jr., *Navy*
Massachusetts Institute of Technology
Benjamin T. Harris, III, *Army*
Sherman Gee, *Air Force*
Michigan College of Mining and Technology
James E. Graham, *Army*
Michigan State University
Jack Schenck, *Air Force*
Mississippi State University
James M. Young, *Air Force*
Missouri School of Mines and Metallurgy
Louis Charles Rephlo, *Army*
Montana State College
Nelson K. Arter, *Army*
Robert B. Jellison, *Air Force*
Newark College of Engineering
George H. Tikijian, *Air Force*
New Mexico College of A. & MA.
Harold E. Clark, Jr.
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The Ohio State University
Gary Thomas, *Army*
Oklahoma State University
Clyde J. Northrup, *Army*
Oregon State College
Eldon H. Graham, *Army*
Gustav E. Wendland, *Air Force*
Pennsylvania State University
Robert B. Fulton, *Air Force*
David Leon Forney, *Navy*
Rensselaer Polytechnic Institute
John R. Rudert, Jr., *Army*
Richard H. Robinson, *Navy*
Rice Institute
Wayne Finis Rogers, *Army*
Robert Michael Lockerd, *Navy*
Rose Polytechnic Institute
William B. Johnson, *Army*
Rutgers—The State University
Victor Tarassov, *Air Force*
Saint Norbert College
Alfred J. Mallette, *Army*
San Jose State College
John G. Herrgott, *Air Force*
Seattle University
Anthony J. Luke, *Army*
South Dakota School of Mines and Technology
Richard L. Stevens, *Army*
South Dakota State College of A&MA.
Donald Lee Rechtenbaugh, *Army*
Curtis O. Nupen, *Air Force*
Stanford University
John G. Rubin, *Army*
Jerry A. Goldstone, *Air Force*
John R. Davis, *Navy*
State University of Iowa
John H. Liechty, *Air Force*
Syracuse University
Richard Burdett Hawkins, *Army*
William E. Lawrensen, *Air Force*
Texas Technological College
Billy Floyd Brown, *Army*
Chris Waddell Clark, *Air Force*
Texas Western College
Paul Weston Paynter, *Army*
Tufts College
David Carlow Trimble, *Navy*
Tulane University
Ronald A. Jacob, *Air Force*
Kenneth Henry Vorhaben, *Navy*
Tuskegee Institute
Guy C. Dilworth, Jr., *Air Force*
Union College
Thomas A. Schaad, *Air Force*
University of Akron
Juris Upatnieks, *Army*
John W. Cozzens, *Air Force*
University of Alabama
Michael Sakellarides, *Army*
University of Arizona
William G. Milam, III, *Air Force*
University of California (Berkeley)
Thomas Michael Healy, *Navy*
University of California (L.A.)
John R. Distaso, *Air Force*
University of Cincinnati
John Rolland Welch, *Army*
Ronald A. Wheeler, *Air Force*
University of Colorado
David W. Glendhill, *Army*
Larie Wendell Holmes, *Navy*

University of Connecticut
Edward J. Jamieson, *Army*
Ross H. Hutchinson, *Air Force*
University of Dayton
Joseph E. Kernan, Jr., *Army*
University of Idaho
George K. Lim, *Army*
Gerald Gregg Steele, *Air Force*
University of Illinois
John L. Geisinger, *Army*
Daniel U. Wilde, *Air Force*
Paul Dean Bowman, *Navy*
University of Kansas
Larry C. Schooley, *Navy*
University of Kentucky
Louis A. Crigler, *Air Force*
University of Louisville
David Jude Elpers, *Navy*
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University of Miami
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University of Michigan
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University of Minnesota
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James B. Dougher, *Navy*
University of Missouri
Stanley W. Faught, *Army*
Jerry W. Vitt, *Air Force*
University of New Mexico
Henry Adelop Germer, Jr., *Navy*
University of Notre Dame
Robert E. Beckerle, *Army*
Daniel A. Green, *Air Force*
University of Oklahoma
Lynn A. Murrell, *Navy*
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Richard John Murphy, *Navy*
University of Rhode Island
John P. Cretella, *Army*
University of Scranton
Donald P. Gaffney, *Army*
University of South Carolina
William E. Queen, *Navy*
University of Texas
Robert W. Swango, *Army*
Berry B. Tolle, *Navy*
University of Toledo
Stephen A. Pivarnyik, *Army*
University of Utah
Rey Wallace Johnson, *Navy*
University of Virginia
Terry A. Tucker, *Air Force*
University of Washington
Brian R. Williams, *Air Force*
Frederick P. Carlson, *Navy*
University of Wisconsin
James E. Dvorak, *Air Force*
John Lowell Baker, *Navy*
University of Wyoming
Dewey R. Henderson, *Air Force*
Villanova University
Walter Stephen Mahle, *Navy*
Virginia Polytechnic Institute
Robert E. Owen, *Air Force*
Washington State University
Harold D. Shoemaker, *Air Force*
Washington University
Wesley T. Diller, *Air Force*
West Virginia University
John Paul Scherlacher, *Army*
Toney R. Perkins, *Air Force*
Youngstown University
Raymond P. Vojtko, *Army*

R. J. Brown, (right) manager, Marketing, General Electric Company's Heavy Military Electronics Department, Syracuse, N. Y., accepts the Company's Sustaining Membership Certificate in AFCEA from C. W. Getz, president of the Syracuse chapter.

General Lyman L. Lemnitzer (left) pictured at the 1960 AFCEA Convention with Admiral Arleigh Burke, USN, Chief of Naval Operations.

General Lemnitzer Named Chairman, Joint Chiefs of Staff

General Lyman L. Lemnitzer, USA, has been named chairman, Joint Chiefs of Staff upon the retirement of General Nathan F. Twining. His honorary membership in AFCEA will be carried over from his former position as Chief of Staff, U. S. Army, to his new position.

General Lemnitzer has been Army Chief of Staff since July, 1959. Formerly he was Vice Chief of Staff and before that he was commander-in-chief, U.S. forces in the Far East and headed the United Nations Command there.

Project Echo Film Available

Word has been received from W. Kelly Mosley, Southern Bell Telephone and Telegraph Company, Region C Vice President, AFCEA, of a new 16mm film, "The Big Bounce," which has been released by the Bell System. The film on Project Echo is in technicolor and runs for 14 minutes.

This documentary shows the actual satellite communications experiments sponsored by the National Aeronautics and Space Administration. Local chapters wishing to schedule this film for a future meeting can contact the local Bell Telephone Business Office.

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UNITED

NEW MEMBERS

Listed below are new members of AFCEA who have joined the Association during the month of August. Members are listed under the chapter with which they are affiliated.

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Richard L. Janss
Capt. Isador Joseph Schwartz
Sven Emil Christensen
Robert C. Sawyer

Augusta-Fort Gordon

PFC. E-E Carroll E. Wisbey
Joseph T. Jordan, Jr.
Capt. Calvin A. Quimby
Jack E. Hicks
William O. Breedlove
GS-11 Alexander C. Billings
Richard E. Worsley
Capt. Edwin F. Kitner

Baltimore

Lt. Col. Roland A. Johnson
Lt. Col. Robert E. Dunlap

Boston

Paul B. Black
Joseph L. Weis
Dean Lebaron
Capt. Charles M. Kelly, Jr.
H. L. Pibus
R. C. Amidon
Russell E. Pomeroy
Frank Blasdel

Cape Canaveral

Milo William Burgess, Jr.

Chicago

Howard Graff
J. Weinberg
E. Vereb
G. Josephsen
W. Hriszko
D. J. Debusman
H. C. Hinckley
J. O. Coffey
J. Garinger
R. Weiss
Morgan Cooper
Robert L. Harris
J. S. Wright
S. Kaplan
J. E. Brown

Dayton-Wright

W. H. Shade
Arnold H. Clark
Charles F. Krause

Decatur

J. B. Gable

Greater Detroit

Lt. Col. Elmer E. Hallinger
Harold E. Reavis

Fort Monmouth

Harold Wood
P. Brandt
1st. Lt. Kenneth K. Kelly
William K. Kindle
Mrs. Florence E. Pawley

Greater Los Angeles

A. J. Brown
Everett L. Stringer
Huntly P. Briggs
Jack Kuhner
J. Myers
Louis A. Pusina
Richard T. McCartney
John R. Moore
C. A. Wolf
E. A. Holmes
W. F. Hafstrom
D. O. Bowman
Richard D. Green
H. Martin
Lt. Col. Ralph B. Crossman
Hugo Romander

Gulf Coast

Ab Hooper
MSGT. Wallis P. Higdon
Fred W. Ronnermann
TSGT. Harold Henthorn
MSGT. John M. Simmons
MSGT. Daniel P. Bricker
MSGT. Luther H. Wooddell, Jr.
Charles Favreau
TSGT. Herbert Simonds
TSGT. Jannar H. Delzquito
TSGT. William A. Turner

Hawaii

M. Samuel Rapold

Kansas City

James C. Sommer
Wilmot Poese

Lawton-Fort Sill

John Franklin Irwin
CWO Richard W. Holmes
CWO W-2 James H. Dilbeck
Arnold P. Dawkins
SP-5 Alvin D. Clary
Capt. James R. Williams
Charles P. Crawford
John C. Cheaney
Donald R. Davidson
Robert R. Quinton
Orval S. Weaver
E. D. Blue
Harold A. Bryant
CWO Frederick R. Spille
Cecil J. Nash
Mack W. Jameson
Robert E. O'Kelley
Paul W. Puckett
Paul R. Harbaugh
John A. Frampton
Henry R. Vargas
Richard V. Anderson
MSGT Leroy A. Tracy
Charles E. Warner
Albert O. McLane
Carlton R. Malone
George F. Roberts
Woodrow H. McCarty
Maj. Richard A. Smith
Benjamin T. Patten
Col. Rudolph Laskowsky
Warren A. Dunn
Capt. Robert M. Kersbergen
Walter F. Pont
Robert D. Saad
Baldwin G. Sullivan
Robert C. Bruner

London

Nicholas Jonas

Montgomery

Capt. Judson J. Copeland

New York

George Zimmerman
William Slawson
Irwin Nadelbach
Herbert J. Goldstein
Dr. R. Burton Power
Ronald M. Litt
1st. Lt. Paul R. Schreier
G. B. Wright
J. R. Whitford
J. J. Rutherford
W. W. Mapes
M. D. Lockwood
A. A. Hauser
Edward H. Jube
B. Maltz
A. D. Metsch
B. Garrett
E. M. Siegel
E. J. Garrett
Leon Alpert
H. L. Willard
D. Domizi
J. E. Brister
William J. Desmond
J. Harold Moore

North Carolina

John C. Ray
W. S. Yeager

North Texas

A. L. Coulson
Elby Martin

Orange

Lt. Col. James A. Trutter

Philippine

SM-SGT. Robert D. Orrell
Ronald T. Lauts
1st. Lt. Kenneth C. Daugard
CWO Edmund M. Dodson
Milton M. Jaraslow
Sherman W. Jones
Capt. John H. Judy
George E. Lacinak
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M-SGT. Johnny O. Smith
Kline D. Stephens
Capt. Arsenio A. Turgeuza
Lawrence A. Weavil
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M-SGT. Walter F. Cox
Maj. Gipson R. Cooley
Maj. Jack A. Clark
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Capt. Stuart E. Aites

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Charles M. Hatcher

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Gerald H. Miller
William C. Neuendorff
Jacques D. Aubry
Edward M. Prather
Raymond E. Hendricks

San Juan

Lt. Col. Joseph T. Bindner
Richard Arthur Robinson
Bruce G. Hosmer

Santa Barbara

Wesley J. Schmitt

Scott-St. Louis

M. W. Bartels
Richard A. Deaton

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David G. Robertson
Harold C. Todd

South Carolina

Joseph F. Tamayo

South Texas

Robert E. Sikes

Southern Connecticut

John S. Ward
Capt. Burton Howell Andrews

Syracuse

E. McLaughlin
Dr. K. C. MacLeish
J. G. Anderson
S. D. Sundell
P. E. Laliberte
H. M. Taylor

Tokyo

James B. Vaughan
Amedeo A. Rende
John M. Michnich

Washington

Joseph Senkow
James W. Jones
Donald W. Tidd
Leolin E. Long
Robert F. Barnack
L. N. Thomas
M. Oliverson
Henry W. Seely
A. G. Merlin
M. L. Rosen
Alphonso B. Petteway, Jr.

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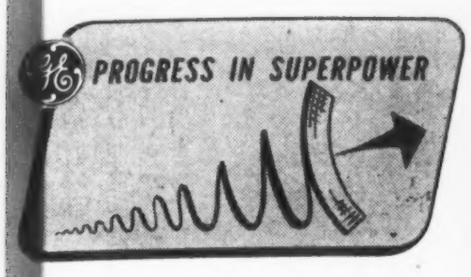
Maj. William H. Washburn
Edward A. Burton
SGT E-5 Leslie J. Fouts, Jr.
Henry B. Graves
Alban F. Hatzell



NEW

Superpower Microwave Tube Laboratory Established in General Electric Power Tube Department

WORK SCOPE INCLUDES APPLIED RESEARCH, ADVANCED DEVELOPMENT AND PRODUCT DESIGN FOR MICROWAVE TUBES PRODUCING RF ENERGY 100 TIMES GREATER THAN CONVENTIONAL TUBES

The General Electric Power Tube Department's new Superpower Microwave Tube Laboratory represents a significant step forward in the technological development of newer forms of radio-frequency energy generation. The Laboratory will continue work on multiple-beam klystrons and other tube types resulting from initial breakthroughs recently achieved by the scientists and engineers of G.E.'s Research Laboratory in the fields of linear-beam and cross-field devices. Based on these technological breakthroughs, the new Power Tube Department Laboratory has the capability of building r-f power sources in a single structure capable of developing CW power outputs in the order of thousands of kilowatts. This represents a dynamic departure in existing klystron technology which heretofore had been limited in practical applications to work with single-beam or combinations of single-beam devices.

With the advent of the new Laboratory, advances of similar magnitude are also predicted in such areas as cross-field power sources. Assumption of the Superpower Microwave Tube Laboratory by the General Electric Power Tube Department—from the Company's Research Laboratory—will facilitate the development of other functions required for marketing of products. Areas of immediate application in the development of new superpower energy sources are in the detection, location and communication with smaller and faster objects. In addition, new applications will undoubtedly include radio-astronomy, satellite space probe tracking, deep space command and communications systems. General Electric Power Tube Department, Schenectady 5, New York. 265-03-8481-31

EMINENT SCIENTISTS TO STAFF LABORATORY

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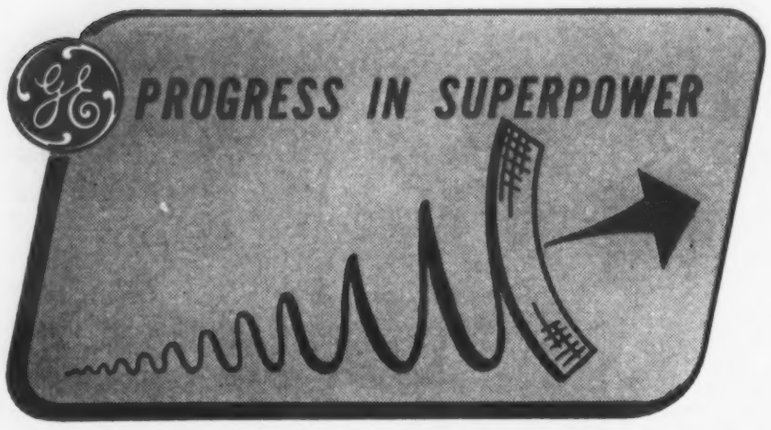
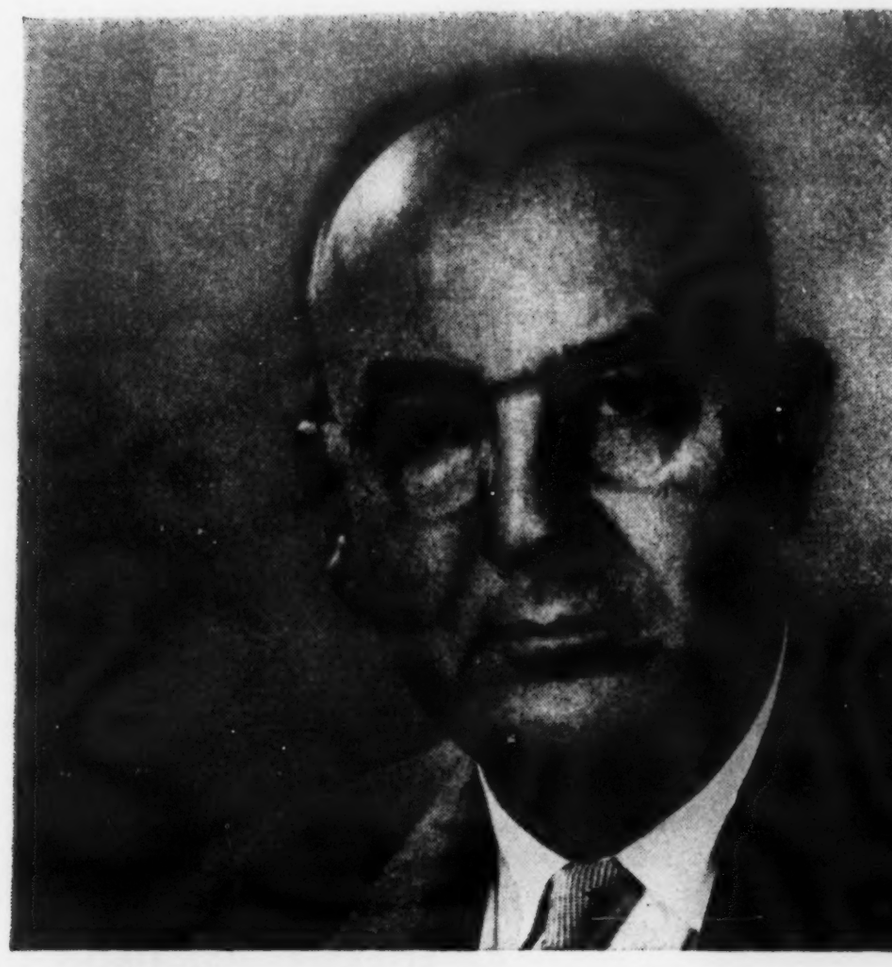


In order to focus more than 200 man-years of collective electronic experience on the further development of new radio-frequency power sources, General Electric's Power Tube Department has a nucleus of highly qualified electronic scientists and engineers drawn from the High-frequency Electronics Section of the General Electric Research Laboratory. They will operate the new Superpower Microwave Laboratory, and be supported by the continuing efforts of Research Laboratory personnel.

The average participation in electron tube activity of the personnel in the new laboratory is twenty years. Collectively, they have contributed to almost every type of electronic tube effort, with most emphasis in recent years in the linear-beam and cross-field areas, the two areas of greatest initial importance to the Superpower Microwave Tube Laboratory.

Eminent Electroni
General Electri



E. D. McARTHUR . . . Mr. McArthur has been named manager of the n Laboratory. Formerly manager of high-frequency electronics research the G.E. Research Laboratory, he is noted as the inventor of the famo radar "lighthouse" planar triodes, first used during World War II. M McArthur carried out early research and development on a wide varie of tubes, including high-power triodes, tetrodes, magnetrons, thyratro and gas discharge tubes for a wide range of applications. He presen holds 64 patents for his work in the field of electronics.

THE SENIOR TECHNICAL STAFF . . .

DR. M. R. BOYD, project manager, traveling-wave multiple-beam klystrons

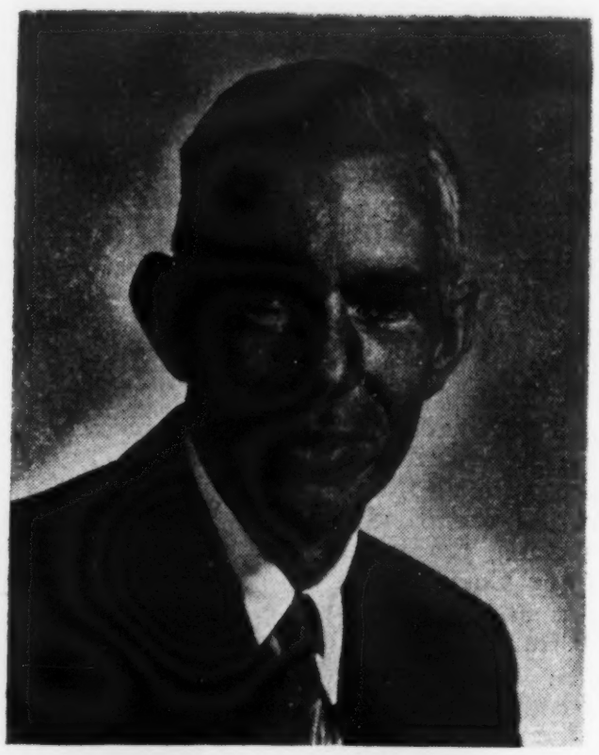
R. A. DEHN, consulting engineer

DR. P. N. HESS, project manager, cross-field amplifiers

J. S. HICKEY, project manager, resonant multiple-beam klystrons

Scientists to Staff New Superpower Microwave Tube Laboratory

LABORATORY MANAGEMENT . . .



R. J. BONDLEY . . . Mr. Bondley, an internationally known authority on the titanium hydride ceramic sealing process, which he developed and applied, will be manager of tube technology in the new General Electric Superpower Microwave Laboratory. His experience covers substantially the whole materials and methods field, including welding, brazing and vacuum technology. Much of his early work was on planar tubes and magnetrons.

Dr. D. A. WILBUR . . . Dr. Wilbur, manager of the supporting research operation, is co-discoverer of the basic principles of the voltage-tunable magnetron, and is noted for work on such developments as neutrode and unimode magnetrons. He is widely known for development of CW magnetrons for ECM, for which he received the Navy Certificate of Commendation in 1947. He is recognized as an international authority in cross-field interactions.

W. H. TEARE . . . Mr. Teare is manager of advanced engineering for the Laboratory. His background includes research and development work on nearly every type of electronic tube and vacuum device. In 1936 Mr. Teare received the General Electric Company's Coffin Award for his efforts in developing metal tubes. For the past several years he has been concerned with General Electric research in high-power klystrons.

. . . SUPPORTED BY

R. E. TURRENTINE, electronics engineer

DR. T. G. MIHRAN, G.E. Research Laboratory

DR. SE PUAN YU, G.E. Research Laboratory

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AFCEA Sustaining and Group Members

Communications—Electronics—Photography

Listed below are the firms who are sustaining and group members of the Armed Forces Communications and Electronics Association. By their membership they indicate their readiness for their share in industry's part in national security. Each firm nominates several of its key employees or officials for individual membership in AFCEA, thus forming a group of the highest trained men in the electronics and photographic fields, available for advice and assistance to the armed services on research, development, manufacturing, procurement, and operation.

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Admiral Corp.
Allied Control Co., Inc.
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American Cable & Radio Corp.
American Institute of Electrical Engineers
American Machine & Foundry Co.
American Radio Relay League, The
American Telephone & Telegraph Co.
Amphenol/Borg Electronics Corp.
Anaconda Wire & Cable Co.
Andrew Corp.
Ansco Division, General Aniline & Film Corp.
Arnold Engineering Co., The
Associated Electrical Industries Ltd.
Automatic Electric Co.
Automatic Electric Sales Corp.
Automatic Telephone & Electric Co. Ltd.
Autonetics, Division of North American Aviation, Inc.
Barry Controls Inc.
Bell Telephone Company of Pennsylvania, The
Bell Telephone Laboratories Inc.
Bendix Radio Division, The Bendix Corp.
Bendix Systems Division, The Bendix Corp.
Bliley Electric Co.
Bruno-New York Industries Corp.
Budd Electronics, Inc.
Burroughs Corp.
California Water & Telephone Co.
Cambridge Thermionic Corp.
Capitol Radio Engineering Institute, Inc.
Carolina Telephone & Telegraph Co.
Central Technical Institute
Chesapeake & Potomac Tel. Co., The
Cincinnati & Suburban Bell Tel. Co., The
Collins Radio Co.
Columbia Broadcasting System, Inc.
Contraves Italiana S.p.A.
Convair/Pomona, Convair Division of General Dynamics Corp.
William C. Copp & Associates
Copperweld Steel Co.
Cornell-Dubilier Electric Corp.
A. C. Cossor Ltd.
Craig Systems, Inc.
Crosley Division, Avco Corp.
Decca Navigator Co. Ltd.
Designers For Industry, Inc.
Developmental Engineering Corp.
Diamond State Telephone Co., The
Dictaphone Corp.
DuKane Corp.
Du Mont, Allen B., Laboratories, Inc.
Eastman Kodak Co.
Electronic Associates, Inc.
Electronic Communications, Inc.
Elgin Metalformers Corp.
Fairchild Camera & Instrument Corp.
General Analysis Corp.
General Telephone & Electronics Corp.
Gilfillan Bros. Inc.
Gray Manufacturing Co., The
Hallamore Electronics Co.
Hallicrafters Co., The
Haloid Xerox Inc.
Hazeltine Electronics Division, Hazeltine Corp.
Heinemann Electric Co.
Hoffman Electronics Corp., Military Products Div.
Hughes Aircraft Co.
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Litton Industries, Inc.
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Loral Electronics Corp.
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Magnavox Co., The
Marconi's Wireless Telegraph Co. Ltd.
Martin Co., The
Materiel Telephonique, Le
McCoy Electronics Co.
Melpar, Inc.
Michigan Bell Telephone Co.
Montgomery Co., The
Motorola Inc.
Mountain States Telephone & Telegraph Co., The
Mullard Ltd.
Muter Co., Rola & Jensen Divisions
Mycalex Corporation of America
National Co., Inc.
Nems-Clarke Co., Div. of Vitro Corp. of America
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North Electric Co.
Northrop Corporation
Northwestern Bell Telephone Co.
Oak Manufacturing Co.
Ohio Bell Telephone Co., The
Pacific Telephone & Telegraph Co., The
Packard-Bell Electronics Corp.
Page Communications Engineers, Inc.
Paraplegics Manufacturing Co., Inc.
Phelps Dodge Copper Products Corp.
Philco Corp.
Photographic Society of America
Plessey Co. Ltd., The
Prodelin Inc.
Radiation Inc.
Radio Corporation of America
Radio Corporation of America, Astro-Electronic Products Div.
Radio Corporation of America, Defense Electronic Products
Radio Engineering Laboratories, Inc.
Radio Frequency Laboratories, Inc.
Raytheon Co.
RCA Great Britain Ltd.
Red Bank Division, The Bendix Corp.
Reeves Instrument Corp.
Republic Aviation Corp.
Rixon Electronics, Inc.
Rocke International Corp.
Ryan Aeronautical Co.
Saxonburg Ceramics, Inc.
Scanner Corporation of America, Inc.
Singer Manufacturing Co., The Military Products Division
Society of Motion Picture & Television Engineers
Southern Bell Telephone & Telegraph Co.
Southern New England Telephone Co., The
Southwestern Bell Telephone Co.
Sperry Gyroscope Co., Division of Sperry Rand Corp.
Sprague Electric Co.
Stackpole Carbon Co.
Standard Electronics Co.
Standard Telephones & Cables Ltd.
Stanford Research Institute
Stewart-Warner Electronics, Div. of Stewart-Warner Corp.
Stromberg-Carlson Co., Division of General Dynamics Corp.
Surprenant Mfg. Co.
Sylvania Electric Products Inc.
Technical Materiel Corp., The
Telectro Industries Corp.
Tele-Dynamics Div., American Bosch Arma Corp.
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Teletype Corp.
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Union Carbide Corp.
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NORTHEASTERN UNIVERSITY: 360 Huntington Ave., Boston 15, Mass. Div. A: Pres.—Albert V. Short; Div. B: Pres.—Harry Giberson.

NORTH TEXAS: Pres.—R. T. Shiels, Anaconda Wire & Cable Co., 1201 Fidelity Union Life Bldg., Dallas 1. Sec.—Robert J. Novak, AT&T Co., 212 No. St. Paul St., Dallas.

NORTHWEST FLORIDA: Pres.—Maj. Ray Kinslow, USAF, Air Proving Ground Center, 3201st ABW, Eglin Air Force Base, Fla. Sec.—Capt. Roy L. Stover, 4751st ABRON, Box 491, Eglin AF Aux. Fld. #9.

OKINAWA: Pres.—Lt. Col. Russell Marks, 313th Air Division, APO 239, San Francisco, Calif. Sec.—Thomas G. Byrd, Jr., Hqs. U.S. Army Signal Group, RYIS APO 331, San Francisco.

ORANGE: Pres.—V. Meder, 744 S. Hampton, Orlando, Fla. Sec.—J. A. Trutter, 1013 Ensenada Dr., Orlando.

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ROCKY MOUNTAIN: Pres.—Col. Howard S. Gee, 3010 Maizeland Rd., Colorado Springs, Colo. Sec.—Maj. C. W. McKelvie, Hq. ADC, Ent AFB.

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SACRAMENTO: Sec.—Capt. Robert McMorrow, 951 La Sierra Drive.

SAN DIEGO: Pres.—Capt. John H. Allen, USN, Navy Electronics Lab., San Diego 52, Cal. Sec.—Paul Vasquez, 9445 Doheny Rd., Santee, Calif.

SAN FRANCISCO: Pres.—H. L. Schnoor, Pacific Tel. & Tel. Co., 140 New Montgomery St. San Francisco 5, Cal. Sec—H. W. Weddell, Rm. 117, Bldg. 35, Persidio of San Francisco, Calif.

SAN JUAN: Pres.—Clyde Dickey, Porto Rico Telephone Co., P. O. Box 4275, San Juan, P. R. Sec.—Albert R. Crumley, Jr., Crumley Radio Corp., Box 10073, Caparra Heights, San Juan.

SANTA BARBARA: Pres.—RAdm. Clarence C. Ray, 63 Manzanita Lane, Star Route, Santa Barbara, Cal. Sec.—Walter W. Montgomery, Raytheon Co., P.O. Box 636.

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SWITZERLAND: Pres.—Capt. Gerald C. Gross, USNR, Intl. Telecommunications Union, Geneva. Sec.—Robert V. Lindsey, Intl. Telecommunications Union, Geneva.

SYRACUSE: Pres.—Colin W. Getz, New York Telephone Co., 108 West Fayette St., Syracuse, N. Y. Sec.—John G. Labedz, Lyndon Road, Fayetteville, N. Y.

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TOKYO: Pres.—H. F. Van Zant, Standard Electric Corp., Box 49, Shiba P.O., Tokyo, Japan. Sec.—G. F. Gray, RCA International Service Corp., Far East Office, APO 323, San Francisco.

WASHINGTON: Pres.—K. B. Lewis, Eastman Kodak Co., 1000 Conn. Ave., Wash. 6, D. C. Sec.—H. A. Crossland, General Electric Co., 777 14th St., Wash. 5, D. C.

WHITE SANDS MISSILE RANGE: Pres.—Maj. M. S. Arbogast, SigC., 217 Rossford Ave., White Sands Missile Range, N. M. Sec.—M. E. Brady, 4939 Blue Ridge Circle, El Paso, Texas.

Chapter News

Atlanta

Chapter president Colonel Kirk Buchak, Signal Officer, Third U.S. Army, called a luncheon meeting at Fort McPherson Officers Club August 3. Former and newly elected officers, members of the board of directors and committee chairman who attended, discussed ways and means of increasing chapter membership and plans for this years program.

Colonel Buchak announced that he has been reassigned to the newly formed Defense Communications Agency in Washington, D. C.

At the September 13 meeting Colonel John E. Morrison of the Baltimore chapter spoke on "Air Force World Wide Communications." Colonel Morrison is chief of Policies and Objectives Branch, Office of Director of Communications and Electronics, Headquarters U. S. Air Force, Pentagon.

The new officers were installed at this meeting. They are: president, Colonel Kirk Buchak, Third U. S. Army Signal Officer (soon to be succeeded by John S. Seigel, Southern Bell Telephone Co.); vice presidents, Captain Jesse Draper, USN (Ret.), Draper—Owens Co.; Gerald H. Ghertner, Cullom & Ghertner Co.; W. L. Mollands, Stromberg-Carlson Co.; Lieutenant Colonel Marvin A. Walter, Headquarters Third U. S. Army; secretary-treasurer, M. S. Butler, Southern Bell Telephone Co. Board of Directors: Harvey J. Aderhold, WLW-A TV; Robert B. Alford, Georgia Public Service Commission; A. E. Arnold, Western Union; E. O. Betscher, American District Telegraph Co.; Colonel Lynn T. Blake, Directorate of C&E, Hq 32d Air Division (SAGE), Dobbins AFB; W. G. Burnett, Southern Bell Telephone Co.; A. J. Cartey, Southern Bell Telephone Co.; E. P. Crutchfield, Western Union; Ben S. Gilmer, Southern Bell Telephone Co.; Charles H. Hardy, Southern Bell Telephone Co.; W. Kelly Mosley, Southern Bell Telephone Co.; G. E. Milliniks, Western Union; Robert C. Sawyer, Georgia Division Lockheed Aircraft Corp; A. M. "Gus" Wilson, Southern Bell Telephone Co.; Brigadier General H. W. Wise, 32d Air Division (SAGE), Dobbins AFB; Captain I. J. Schwartz, U. S. Navy, Naval Air Station, Marietta, Georgia. Committee Chairmen: Civil Defense, J. S. Bonner, AMACD; House, Major Wilbur W. Wright, Headquarters Third U. S. Army; Membership, Colonel Hoyt E. White, Headquarters Third U. S. Army; Program, A. W. Webber, Southern Bell Telephone Co.; Publicity, Coleman E. Alford, Headquarters Third U. S. Army; Reception, Victor O. Gain, Southern Bell Telephone Co.

(*Continued on page 66*)

New York—Henry Bang (center), chapter president, congratulates Colonel William Jennings on his new duties at the Signal Corps Electronics Proving Grounds at Fort Huachuca, Arizona. Colonel Charles A. Stanley (right), looks on. Colonel Jennings and his staff arranged the Annual Chapter Dance at Governors Island held on June 15.

Okinawa—Guests at a reception for H. T. Killingsworth, vice president, Longlines, American Telephone and Telegraph Corp., held July 7, at the Fort Buckner Officers Club included: L to R. Earle N. Dotson, Chief of Communications, USCAR; Lt. Col. Russell H. Marks, 313th Air Division, chapter vice president; Col. Edward C. Coffin, Jr., Signal Officer, U. S. Army Signal Group, chapter president; J. Ballard Atherton, president, Hawaii Telephone Corp; Mr. Killingsworth; Charles C. Duncan, vice president, American Telephone and Telegraph Corp., Douglas S. Guild, vice president, Hawaii Telephone Corp. Mr. Killingsworth presented the chapter charter to the newly organized group which is the 10th foreign chapter.

San Francisco—Pictured at the July 21 dinner meeting at Presidio Officers Open Mess are: L to R, Lt. Gen. James D. O'Connell, USA (Ret.), former Chief Signal Officer; Col. Homer L. Davis, Jr., Signal Officer, Hq. Sixth U. S. Army; Hon. Frank H. Higgins, Assistant Secretary of the Army, Logistics (Ret.); Samuel Myer, great-grandson of General Albert Myer, founder of the Signal Corps. Mr. Higgins, guest speaker, addressed the meeting on "World Current Topics." Mr. Myer gave a short talk on his great-grandfather, General Myer, telling some sidelights on his military career.

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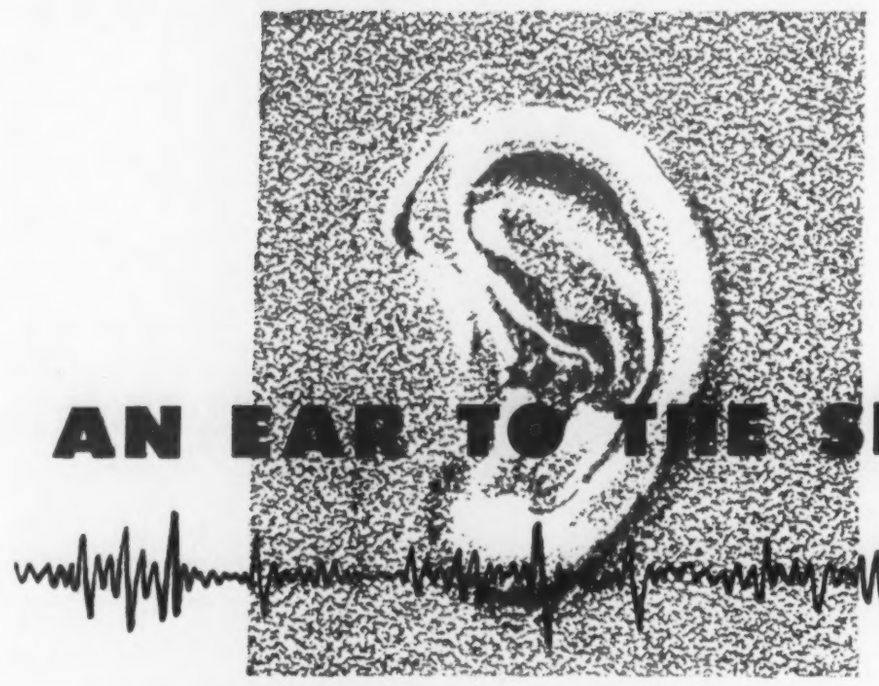

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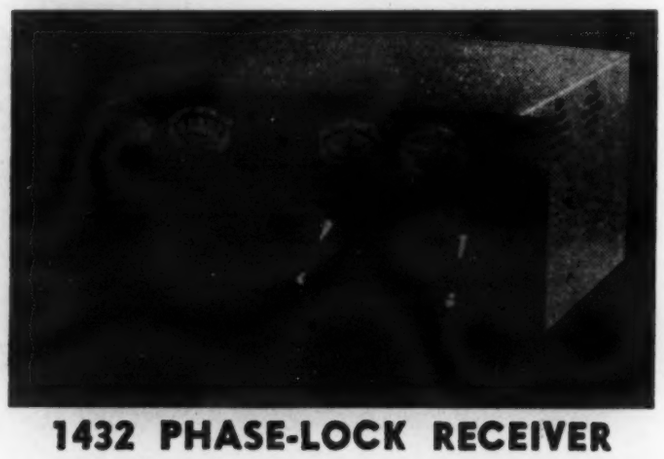

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Chapter News, (*Cont. from* p. 64)

Fort Monmouth

At the September 15, meeting held at the Sapphire Room, Gibbs Hall, Fort Monmouth Officers Club, members heard a talk by Colonel and Mrs. Clyde R. McBride. Colonel McBride, former U. S. Army attaché to the USSR, talked on "Attaché Impressions of the USSR." Mrs. McBride discussed aspects of interest to the women. Film strips and color slides supplemented the talks.

Plans have been announced for future meetings of the chapter. Lieutenant General Arthur G. Trudeau, Army Chief of Research and Development, will speak at the October 20 meeting. Dr. Lloyd Berkner, chairman of the Space Science Board and vice president of the special committee for the IGY will present the topic "Accomplishments of the International Geophysical Year" at the November 17 meeting. The December meeting will be reserved for the annual Christmas Party. Plans have not been completed for the January 19 meeting. Major General J. B. Medaris, USA (Ret), former chief of the Army Ordnance Missile Command, will address the chapter at the February 16 meeting.

Montgomery

Mr. Oran P. South, Research Studies Institute, Maxwell Air Force Base, and Dr. Hugh C. MacGuire were guest speakers at the August meeting of the chapter. The meeting was held at the Maxwell Air Force Base Officers Club.

Mr. South and Dr. MacGuire presented a program on the future Atomedic Research Center in Montgomery.

Chapter president Lieutenant Colonel Herbert Herman introduced Mr. and Mrs. W. Kelley Mosley, honored guests for the occasion. Mr. Mosley, assistant vice president, Public Relations Department, Southern Bell Telephone Company, Atlanta, is a regional vice president of the Association.

Philippine

Following lunch at the American Legion Club on August 5 the chapter held a meeting. Future plans for the chapter as well as plans for the election of officers were discussed.

Speaker at the meeting was Captain W. E. Williamson, Army Map Service and OIC for Project "Betty" at Clark Air Base. He spoke on the Clark satellite tracking station and its place in the world-wide operations of Project "Betty."

Scott-St. Louis

The chapter held a Get Acquainted dinner meeting September 9, at Augustine's Restaurant. Mr. J. L. Eschbacher, Engineering Department, Southwestern Bell Telephone Company, spoke.

His talk, "Voices Across Time and Space," described the Project Echo experimentation, in which the Bell Laboratories participated along with NASA and the Jet Propulsion Laboratories.

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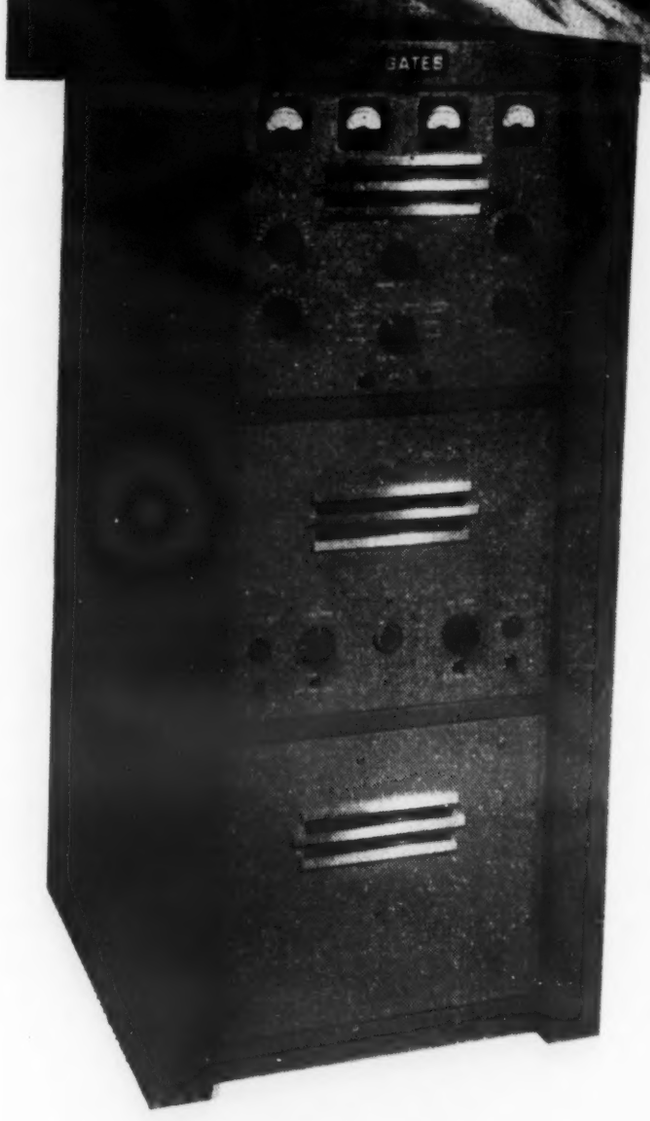

Vital to the success of "Project Mercury" will be the 21 Gates MPS-29 High Frequency Transmitters at tracking stations throughout the world helping to maintain constant ground-to-air contact with the capsule. For this dramatic, unprecedented communication link, specifications were ultra critical and fast delivery imperative. *Gates was the manufacturer who could meet the specifications in the required time.*

Whether your communication need is ground-to-air, point-to-point or maritime, Gates can meet your requirements in record time with the MPS-29. It is basically a flexible two-channel high frequency transmitter intended for double sideband voice communication. The two channels can be pre-set anywhere within the normal 15-30 megacycle range (2-15 mc coverage can be provided.) Channel switching and press-to-talk functions can be handled remotely over telephone pairs. Audio clipping and filtering give maximum "talk power." Provision is made for local operation by a microphone input. Cabinet, harmonic and spurious radiation and conducted interference exceed the stringent requirements of MIL-I-26600. Minimum *output* is 250 watts. Frequency tolerance is .0005 or better. Size: 50" high, 23" wide and 26" deep.

The regular M-4575 CMG-1 single channel model is available with continuous tuning from 2-32 mc.

Learn how Gates can meet many systems requirements. For further information please contact our Government Contracts Department. Your inquiries are welcome.

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NEWS ITEMS AND NEW PRODUCTS

Current Developments in Automatic Data Processing Systems will be the theme of the Seventh Institute on Electronics in Management to be held at The American University, Washington, D. C., from October 31 through November 4, 1960.

Sponsored by the school of Government and Public Administration, the Institute is designed for management personnel, both line and staff, who are engaged in planning or using automatic data processing systems.

Topics to be covered include: integrated data systems, techniques for source data automation, advanced management information systems, and information storage and retrieval—theory, methods and equipment.

To enroll or request further information, write to Dr. Lowell H. Hattery, Director, Seventh Institute on Electronics in Management, The American University, 1901 F Street, N. W., Washington, D. C.

• • •

The National Defense Education Institute began the fall series of courses in Government Contracting August 15 in Dallas, Texas. Other cities to be included in the schedule are: Washington, D. C., Oct. 10-Oct. 21; Detroit, Oct. 24-Nov. 4; Dayton, Nov. 7-Nov. 18; and Los Angeles, Nov. 28-Dec. 9.

The National Defense Education Institute, which is jointly sponsored by the National Security Industrial Association and Harbridge House, Inc., is basically an extension of NSIA's program to increase the efficient carrying out of our National Defense efforts and to bring about improvements, where needed, in the over-all field of Government Contracting.

A brochure stating the scope and purpose of the course and presenting an outline of the major areas covered is available from National Defense Education Institute, 1107-19th Street. N. W., Washington, D. C.

• • •

An expense grant to aid in the establishment of a medical television internship by the Institute for the Advancement of Medical Communications has been awarded by the Blonder-Tongue Foundation, Newark, N. J.

The grant will provide doctors or other interested persons in the medical field the opportunity to study the latest techniques in closed circuit television. The purpose is to expand the use of this method of visual communications for medical education. Closed circuit television is now being utilized in many modern medical schools for effective demonstrations by doctors who want to give students and colleagues a critical look at complicated operations.

The Blonder-Tongue Foundation is supported by the Blonder-Tongue Laboratories, Inc., of Newark, N. J.

• • •

Consulting electronic engineering services for manufacturers interested in Radio Frequency Interference measurement and control are being made available through a new Hollywood, California firm, A. T. Parker and Associates.

The new organization is oriented principally toward the broadband interference aspects, rather than the frequency allocation phase of RFI work. Its activities are designed to provide engineering assistance in seven major categories including determination of systems compatibility, the interference "spectrum signature" and interference susceptibility characteristics of systems or component parts of systems.

Information may be obtained from A. T. Parker and Associates, 5909 Melrose Avenue, Hollywood, 38, California.

• • •

The American Industrial Writing Institute has been established to improve the quality of business and technical communications. The new group has resulted from the merger of the Technical Writing Improvement Society (TWIS), a national organization of educators, trade journal and industrial editors, and engineering management people, and the Western Technical Writing Institute (WTWI), a West Coast technical writing school.

The new organization was formed to meet the need for a central clearing house and information center on industrial communications improvement. AIWI will publish a bimonthly writing improvement bulletin for management and a quarterly newsletter for engineering and science writers. It is intended that the material issued to industrial firms and scientific organizations will form a continuing course of instruction for technical people.

Individual memberships in the new Institute will be by invitation. Company subscribing membership will be available. Temporary headquarters of the new organization are in Pasadena, California. John L. Kent is director of the Institute.

• • •

Electronic Associates, Inc. displayed a model of its weather plotter at the WESCON Show is Los Angeles last August.

The units, purchased by the U. S. Weather Bureau for installation at Pt. Mugu and Monterey, California, will be used to plot weather maps from digital information on magnetic tapes, recorded by weather stations all over the world. These weather maps will be used by the Pacific Missile Range for planning of missile test firings.

• • •

Telecomputing Corporation's Electronic Systems division of Los Angeles has developed a system for more precise measurement and position determination of satellites as well as position designation of celestial bodies in relationship to earth. The system, known as Phasolver, is to be installed in conjunction with the Army Redstone Arsenal's 84-foot radio telescope antenna at Madkin Mt., Alabama.

The Phasolver converts small mechanical motions to large electrical phase shifts. These can then be digitized to provide very precise information on such measurement determinations as rotational position of a shaft and linear travel of a moving number. The system is capable of precisely measuring rotary movements as small as 3-seconds of an arc (1/432,000 of a complete turn) and it is expected its capability will reach 1-second of an arc (1/1,296,000 of a complete turn) in the near future, a company spokesman reports.

A Phasolver system consists of two main units: the transducer, or sensing device, attached to the element whose rotation is to be measured; and the associated electronics and digitizing equipment. The transducer is essentially a highly accurate electrostatic shifter. It consists of a pair of dimensionally stable non-conducting discs,

New Microwave For Secure TV and Radar Relay

The widest band microwave equipment made today comes from Raytheon, world's largest manufacturer of microwave tubes and equipment. It is designated KTR 1000G (FS) and operates in the 5925 to 7425 Mc range.

This equipment is suitable for high-information pulse data transmission such as secure TV. It is also capable of transmitting from a radar site to a remote indicator, images of the highest definition possible today in a radar relay.

KTR 1000G (FS) is one more example of Raytheon's capability to develop advanced microwave systems for military engineering agencies and their suppliers.

SPECIFICATIONS

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Rise Time
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Output
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Package
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one of which rotates with respect to the other. Each disc carries a pattern of conducting metal film. The two patterns mounted facing each other, and closely spaced, are known as the driver and coupler. Input and output connections are made to the driver pattern. The coupler pattern couples energy electrostatically from the driver pattern and produces the output signal which is transferred to the load by means of output coupling rings in the driver pattern. Since there are no physical connections to the coupler disc it is fixed to the element whose rotation is being measured, while the driver disc is fixed to the supporting frame.

The pattern configuration provides an output signal with constant amplitude and a phase angle, referred to as the input signal, which is proportional to the rotary position of the coupler disc.

• • •

A lip-stick size infrared detector has been developed by Raytheon Company. The detector can be used in units to pinpoint "hot spots" betraying the presence of aircraft, missiles, launching pads, or rocket motor test areas concealed by darkness. The detector generates no beam from which the enemy might trace its location.

Raytheon's development which can spot objects warmer than the human body from miles away, is the smallest known metal-encased unit in the field of infrared detectors. Its long-range operation, size and metal casing make the detector particularly applicable for aircraft and missiles. The casing was designed to withstand vibration and "g" forces to be encountered in missile flight. Long-range capabilities and space-saving size make it useful as a reconnaissance aid for aircraft or as a component for missile guidance systems.

Raytheon is currently working on a similar unit which would permit long-range detection of infrared energy or heat sources near human body temperatures.

• • •

Astromics of Glendale, California, a division of Mitchell Camera Corp., has developed a new relay, designated A-2A. The latching relay's contacts are held in position by a mechanical lock, rather than a magnetic hold device which is vulnerable to shock and vibration. The movable contact assembly locks positively in either of two alternate switching positions.

The A-2A requires only short duration operating pulse currents, and. when locked in position, cannot be moved or altered in any way until a new command pulse is applied. It is a truly bi-stable switch, according to the company, in that a single pulse can be used to change position and maintain it. No reversal of polarity is needed to effect a subsequent change in position, as required in magnetically-latched relays.

• • •

A research team at the U.S. Army Ordnance Frankford Arsenal, Philadelphia, has developed a computerized checkout system to take guesswork out of automotive repair. The automatic checkout system also enhances vehicle reliability by accurately isolating possible sources of trouble before malfunction actually occurs.

The technique for the system is to interrogate the vehicle with a number of sensing elements (transducers) under both static and dynamic conditions and, use logic and computer circuitry to isolate specific mechanical malfunctions.

A LIBRATROL—500 digital control computer, manufactured by the Burbank Calif., Branch of Librascope Div.-General Precision, Inc. is the heart of the automatic-vehicle checkout system. The computer which has been modified to accept magnetic tape input, is an on-line control computer system with an input rate of 75 data words of 31-bit length per second. The computer utilizes an interrelation of a number of measurements to diagnose malfunctions. This interrelation of measurements is preprogramed into the computer as used in the unit under test. The entire checkout operation is performed with the vehicle's components in their normal operating position and condition.

Included in the checkout system are a voltage-to-digital converter for translating transducer voltage responses into digital form; a Flexowriter for interrogation, command input and print-out; a magnetic tape storage unit; and accessory equipment for relaying, filtering, amplifying, switching, etc.

• • •

The Semiconductor Division of Hoffman Electronics Corp. is expanding its line of Zener reference devices by adding two subminiature glass, 400 milliwatt, diffused junction low temperature coefficient units.

Designated EIA types 1N821 and 1N822, the voltage reference devices meet or exceed the environmental and

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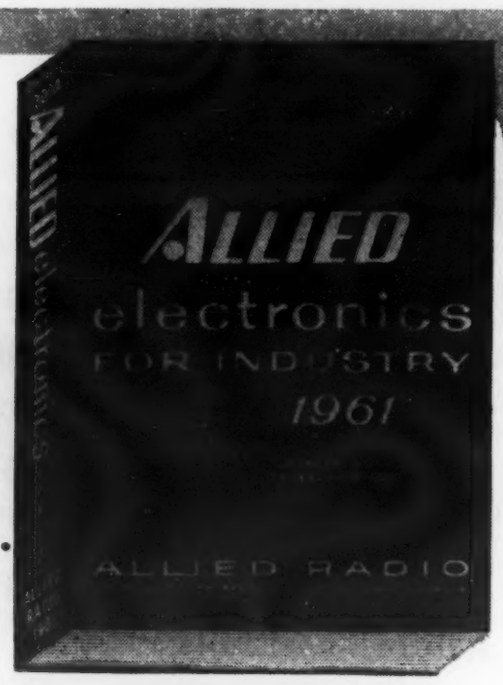

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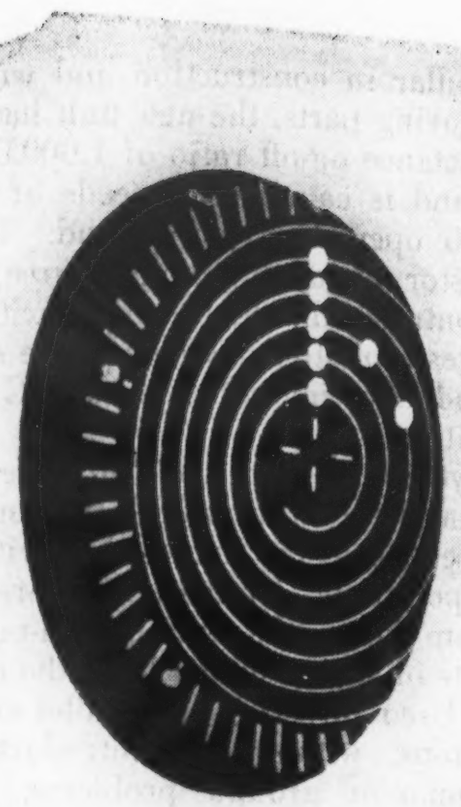

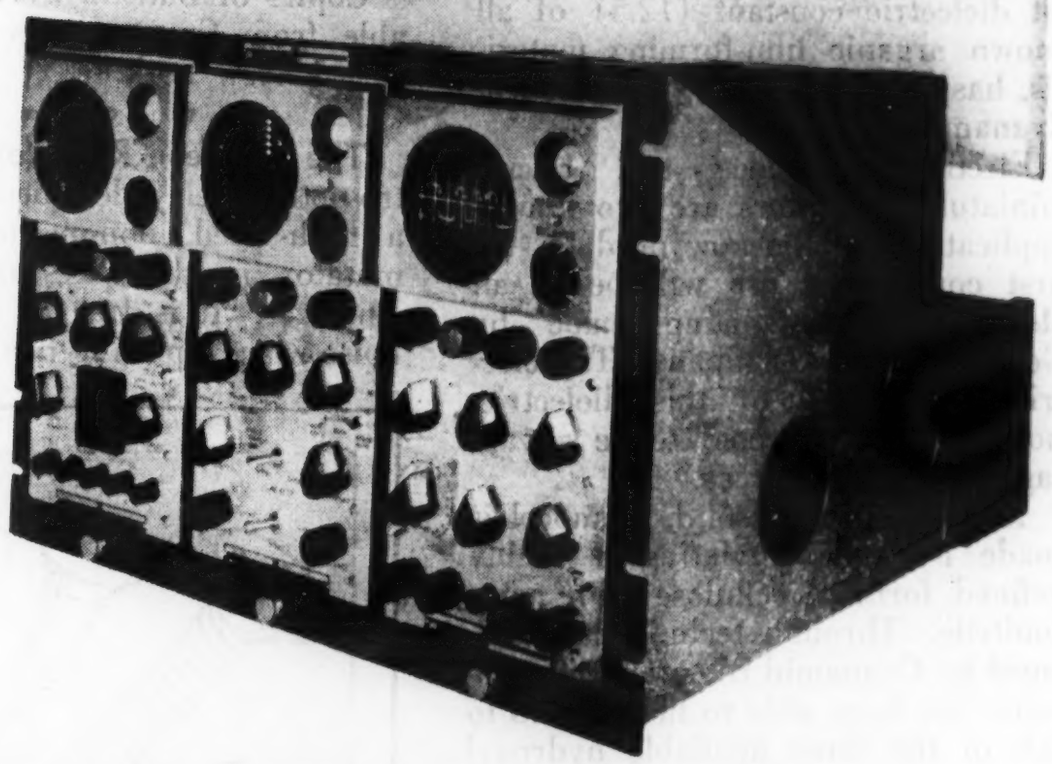

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For detailed information on the TDMS, write for Bulletin RAD E-100B to Radiation Inc., Melbourne, Fla. Address Dept. S-10

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RADIATION INCORPORATED

life tests requirements of MIL-E-1/1134, which has been established for the electrically equivalent 1N429.

The 400 milliwatt package enables these new units to handle high repetitive surge currents. The package, which has axial leads, places less restrictions on mounting. Further, a 40 mil diameter dumet heat sink and copper lead contribute to the low thermal resistance of the device.

Voltage range of these units is 5.9 to 6.5 volts at 7.5 milliamperes and 25°C. The temperature coefficient, over a range of —55°C to 100°C, is ± 0.01 percent per degree C. Maximum dynamic impedance is 15 ohms at 25°C and 7.5 milliamperes. Maximum operating temperature at 7.5 milliamperes is 150°C.

• • •

Cyanocel, a new film-forming and moldable dielectric that has the highest dielectric constant (12.5) of all known organic film-forming materials, has been developed by American Cyanamid Company.

Electroluminescence and microminiature capacitors are two known applications of the new product. Its first commercial use will be in an electroluminescent lamp made by General Electric Company. The electrical properties of this dielectric, however, are expected to be advantageous in other areas.

A white, fibrous solid, Cyanocel is made by cyanoethylating a highly refined form of cellulose with acrylonitrile. Through techniques developed by Cyanamid research, the company has been able to modify 2.6 to 2.8 of the three available hydroxyl groups on each gluocosidic unit of cellulose with a cyanoethyl group.

• • •

The Dictaphone Corporation has announced the development of the Dictachron Time Announcer which automatically announces, for recording, the time of receipt of any communication recorded by a number of Dictaphone-developed communications recording machines.

The Dictachron uses a tape on which the time has been pre-recorded in hours and hundredths of hours, based on the 24-hour clock. Twelve hours are pre-recorded on one side of the tape; the remaining 12 hours are pre-recorded in the reverse direction on the other side. The tape automatically advances in step with the time during the first 12 hours, and then moves in reverse direction during the second 12 hours. There are two reproducing heads, each covering one of the 12-hour time channels.

Crouse-Hinds Bulletin 2716 describes a school signal system (PA-300) with an electronic controller, designed for operation at mid-block crossings, which are safer places for children to cross streets as they do not have to avoid turning traffic.

During morning, noon and afternoon periods, the signal operates automatically in response to push buttons. At other periods, the signal remains on normal highway "Go" indication. On non-school days the signal remains on highway "Go" continuously. When school reopens, operation resumes automatically in accordance with the previously set schedule.

An electronic controller provides simple timing adjustments. Control knobs are easily turned to desired settings; no changing of gears or setting of dial keys is required.

Copies of Bulletin 2716 are available from Crouse-Hinds Co., Syracuse 1, New York.

• • •

The Raytheon Raysistor is an electro-optical relay designed for use as a high-speed, non-mechanical commutator in the Rayspan Spectrum Analyzer. It is free of any contact noise when replacing relays or potentiometers.

Tubular in construction and without moving parts, the new unit has a conductance on-off ratio of 1,000,000 to 1 and is capable of speeds of up to 100 operations per second. The Raysistor includes a light source in the control end, which, when excited, actuates a photo-conductor in the signal end, allowing either AC or DC information to pass.

Raytheon reports the "on" life of the Raysistor is around 2500 hours, irrespective of the number of switching operations. Unlike transistors or vacuum tubes, the unit is non-polar and its input is isolated from the output. Used in series or parallel combinations, without the introduction of common ground problems, the Raysistor may be applied to logic circuits and matrices for telemetering or signal commutation.

• • •

An electronic scouting system, the AN/USD-5, which will provide a field commander with instantaneous information on the enemy's disposition and activities, has been developed and successfully tested. The system includes two air-transportable huts, the jet-powered, delta-wing drone and associated mobile launch

TELEVISION

The Principal TASO Findings on

June PROCEEDINGS *presents an exclusive report of world-wide significance*

IRE is proud to present, in June 1960 Special Issue of PROCEEDINGS, the findings of a team of 271 engineers who for 2½ years conducted studies of world-wide significance for the future of television. The *Television Allocations Study Organization* — formed by the TV industry in 1956 at the FCC's request — has exhaustively analyzed the engineering factors underlying allocation of frequencies for VHF and UHF television broadcasting.

As the number of television services grows, a better use of TV channels becomes increasingly important. TASO engineers first drew up specifications for measuring TV field strengths; then sifted data on field strengths of VHF and UHF. They have discovered reasons for hitherto unexplained deviations, and have also sought to establish a relation between field strength and picture quality.

How good are directional TV transmitting antennas? The results of extensive field tests are analyzed. To what extent do interfering signals and noise affect picture quality? How accurately can one predict an interfering field? These and other questions are answered.

So important are the TASO findings that IRE has allocated 120 pages to them. If you are not already an IRE member, we suggest you send in the coupon below to reserve a copy, for the June 1960 PROCEEDINGS will surely remain the definitive work on VHF and UHF TV for many years to come.

List of contents:

BE SURE YOU READ THESE ARTICLES!

"Television Allocations Problems" by E. W. Allen, Federal Communications Commission

"The Television Allocations Study Organization"—a Summary of its Objectives. Organization and Accomplishments" by George R. Town, exec. dir. of TASO; Iowa State University

"Measurement of Television Field Strengths in the VHF and UHF Bands" by H. T. Head, A. D. Ring and Associates; and Ogden L. Prestholdt, CBS-TV

"Forecasting Television Service Fields" by Alfred H. LaGrone, University of Texas

"Influence of Trees on Television Field Strengths at Ultra-High Frequencies" by H. T. Head

"Tropospheric Fields and their Long-Term Variability as reported by TASO" by Philip L. Rice, National Bureau of Standards

"Picture Quality—Procedures for Evaluating Subjective Effects of Interference" by G. L. Fredendall and W. L. Behrend, RCA Labs.

"Measurement of the Subjective Effects of Interference in Television Reception" by Charles E. Dean, Hazeltine Research Corp.

"Studies of Correlation between Picture Quality and Field Strength in the United States" by C. M. Braun and W. L. Hughes, Iowa State University

"Relative Performance of Receiving Equipment as reported by TV Servicemen" by Holmes W. Taylor, Burroughs Corp.

"VHF and UHF Television Receiving Equipment" by William O. Swinyard, Hazeltine Research Corp.

"Findings of TASO Panel I on Television Transmitting Equipment" by H. G. Towlson of General Electric Co. and J. E. Young, RCA

"Determining the Operational Patterns of Directional TV Antennas" by F. G. Kear, of Kear and Kennedy, and S. W. Kershner, of A. D. Ring and Assoc.

"Sound-to-Picture Power Ratio" by Knox McIlwain, Burroughs Corp.

"Presentation of Coverage Information" by D. C. Livingston, Sylvania Electric Products, Inc.

"The Television System from the Allocation Engineering Point of View" by Robert M. Bowie, Sylvania Research Labs.

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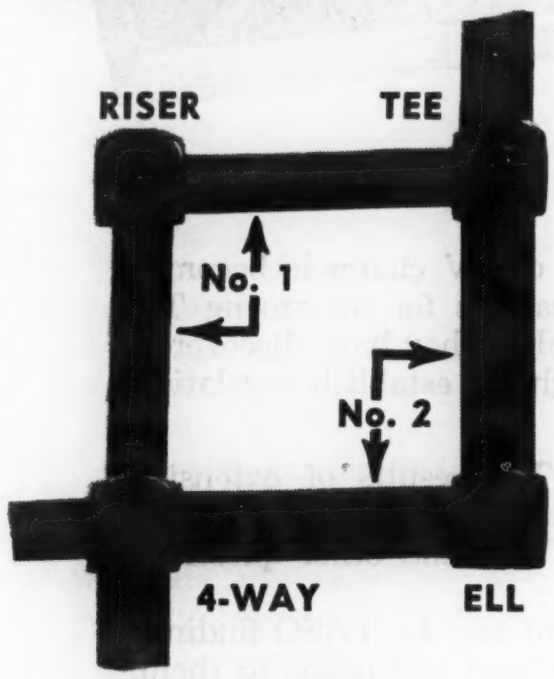

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and recovery equipment.

The air vehicle, which has a wing span of 24 feet, overall length of 36 feet and is 8 feet in height, weighs 8,500 pounds and is powered by a 3,000 thrust turbo-jet engine. The airframe is fabricated largely of fiberglas plastics. Various sensors such as infrared and new airborne surveillance radar, can be carried in the nose sections and changed in accordance with the selected mission. Because it is launched from a flatbed trailer, the drone requires no prepared air strip. Upon return to any pre-selected area the drone is decelerated and let down by twin parachutes deployed from a compartment at the top of the fuselage. Three air bags which eject from each wing and the nose compartment inflate as the drone descends and cushion the landing impact to minimize damage. To preclude dragging, the parachutes detach automatically when the drone lands. The drone can then be lifted by helicopter or loaded on a standard Army flatbed truck and returned to the launch site for another mission.

The drone's flight can be preprogrammed to cover areas of interest. It uses inertial guidance and will not depend on radio commands or other ground control. It can follow the contour of the terrain to avoid detection or be made to climb automatically to high altitudes. The drone's high speed makes it a difficult target for ground fire. Equipment in the two huts acquires and processes the information sent back by the drone making data readily useable.

The AN/USD-5 drone has been successfully flight tested at Yuma Test Station on May 14, and June 26, 1960. During the first test it was aloft 70 minutes and on the second test 2 hours. The minimum and maximum range has not been determined.

The entire AN/USD-5 system, including the huts, drones and launching equipment can be transported by standard Army vehicles, helicopter or airlifted in cargo aircraft. Estimated cost is $2 million per ground system and $350,000 to $400,000 per aerial unit. The system is being developed with the Army Signal Corps by Fairchild Engine and Airplane Corporation of Hagerstown, Maryland, under the direction of the U.S. Army Signal Research and Development Laboratory, Fort Monmouth, New Jersey.

• • •

A new VHF Doppler radio direction finder has been presented by the Servo Corporation of America. Developed by Servo on a commercial basis and currently under evaluation by the military and FAA, the Servoflight® DFG-4A Doppler Radio Direction Finder Set provides instantaneous, unambiguous azimuth readings automatically, the company reports. Accurate bearings are displayed as a single strobe line on a 7" diameter cathode ray tube. Use of a wide-aperture antenna in conjunction with the Doppler operating principle reduces the effects of local side reflections on bearing accuracy. Accuracy is maintained to within ± 1 degree.

• • •

The Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. is publishing a weekly review of scientific and technical articles appearing in the Soviet press and of significant new Russian books.

Current Review of the Soviet Technical Press, (Order No. 60-21441) is sold on subscription by OTS at $7 for six months. An additional $2 is required for foreign mailing.

• • •

The following publications are available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Tabulation of Data on Receiving Tubes, by C. Marsden, W. Keery and J. Moffitt; National Bureau of Standards Handbook 68, issued Nov. 1. 1959; 110 pages, $1.00. This tabulation of data on receiving tubes currently in use has been prepared from information taken from manufacturers' published specifications.

Electron Tubes and Semiconductors, Selected Latin American Countries, R. Cannon and A. Anderson. Electronics Div., Business and Defense Services Administration, U. S. Department of Commerce; 21 pages. 25¢. This is the second in a series of foreign market surveys of electron tubes and semiconductors and covers Argentina, Brazil, Chile, Colombia, Cuba, Mexico, Peru, Uruguay and Venezuela.

• • •

QED—the *Quarterly Electronics Digest* is a new publication of the Defense Electronics Division, Light Military Electronics Department of General Electric. The publication is aimed at informing the makers and users of military electronics products.

Volume One, Number Two of QED features articles on military satellite communications, microelec-

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Magnavox continues to maintain a position of leadership in the airborne communications field.

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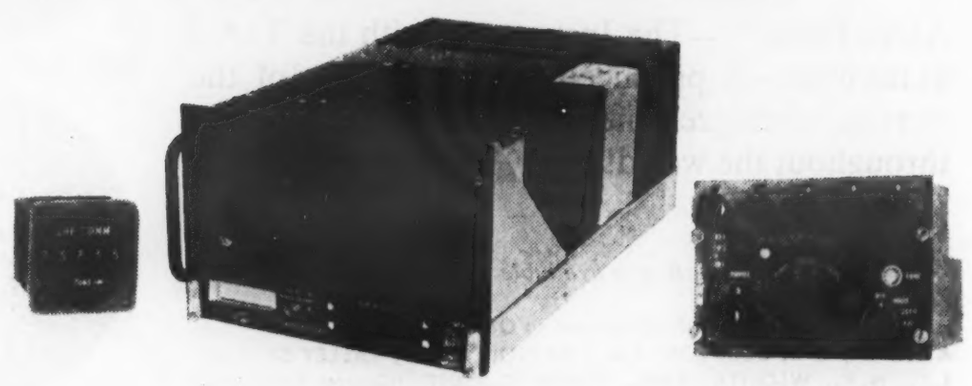

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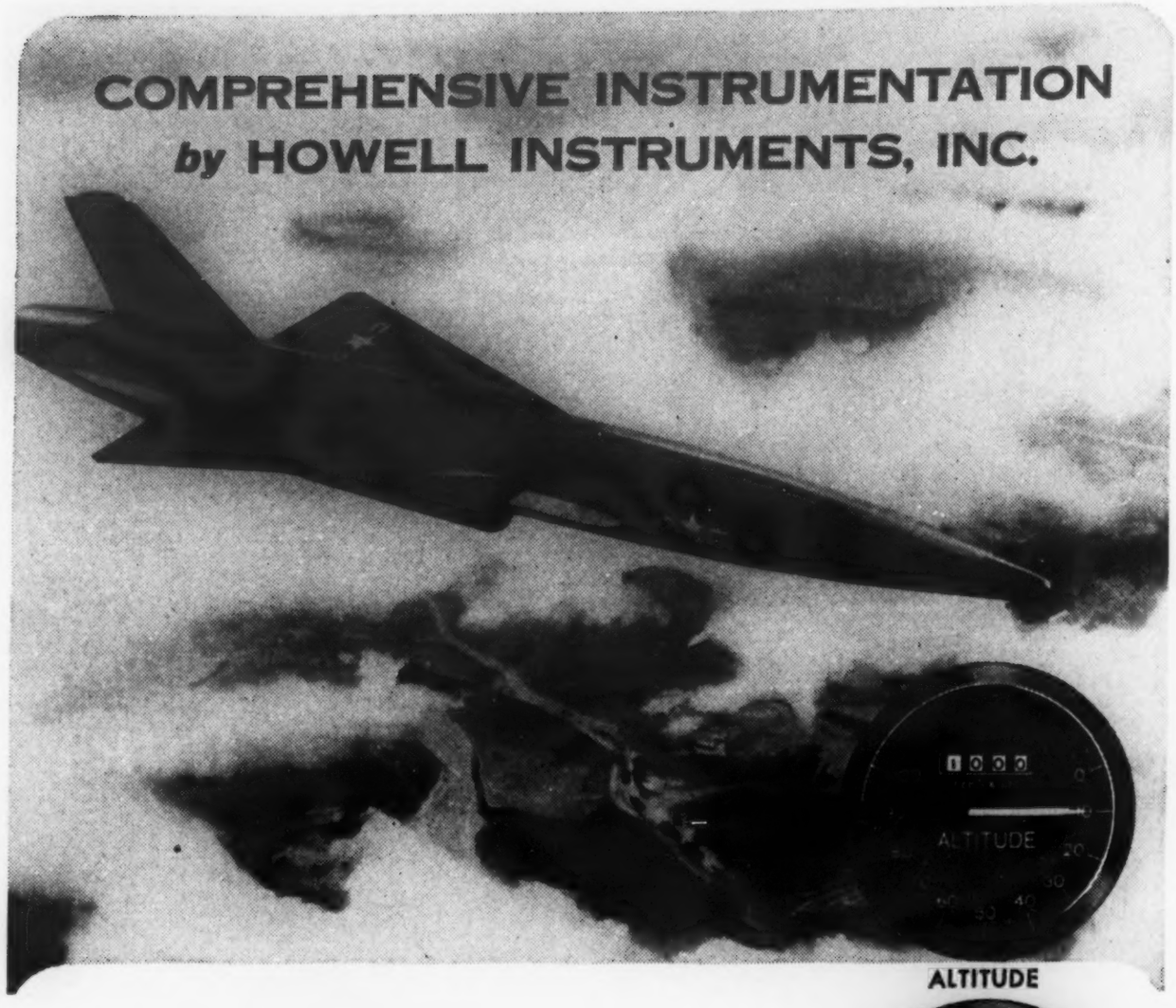

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Prospective authors of papers to be considered for presentation before the 1961 Institute of Radio Engineers Convention next March should submit the following information by October 21, 1960: a 100-word abstract in triplicate, title of paper, name and address; a 500-word summary in triplicate, title of paper, name and address; and, indicate the technical field in which the paper falls.

Only original papers will be considered, not published or presented prior to the 1961 IRE International Convention. Necessary military or company clearance of papers should be granted prior to submittal. Send all material to Dr. Gorden K. Teal, Chairman, 1961 Technical Program Committee, The Institute of Radio Engineers, Inc., 1 East 79th Street, N. Y. 21, N. Y.

• • •

Blueprint for Industrial Survival, issued by the Standard Oil Co., N. J., describes the company's Emergency Headquarters at a remote rural location outside New York City. The pamphlet describes Jersey Standard's plan to continue the company's vital operation in event of enemy attack.

Stanford Research Institute of Menlo Park, California has also issued a booklet describing its plan for survival of its employees in the event of nuclear attack. This booklet, entitled *LIVE*, follows a study to determine whether low-cost civil defense measures could protect SRI staff and their families from atomic attack. Bases for the study were a number of research projects conducted by SRI for the Office of Civil and Defense Mobilization and the Army Signal Corps, and planning material furnished by OCDM. *LIVE* is available in limited quantity upon request to OCDM Operational Headquarters, Battle Creek, Michigan.

• • •

The Communications-Electronics Doctrinal Project Office of Research Studies Institute at Maxwell AFB, Alabama, has published a 25,000 item dictionary called *Communications-Electronics Terminology, Definitions and Abbreviations.* The Air Force Manual 100-39, dated July 1, 1960 is available from the Government Printing Office, Washington 25, D. C.

The manual provides complete cross-reference, listing of terms, nicknames, designations, abbreviations

(*Continued on page* 82)

For the U.S. Marines—ASSIGNMENT INTERCEPT

An advanced tactical early warning radar, Sperry's extended-range MPS-21 is scheduled for adoption by the Marine Corps. The air-transportable system sets up in less than eight hours to provide concise information for control of combat interceptors.

The radar antenna searches near and far skies providing the operator with range, height, and azimuth data. Height readout is numeric, requiring no calculation. The equipment can be adapted for track-while-scan operation. Radome is a dual-wall air supported structure, compartmented so as to remain effective even when a number of the sections have been pierced.

In all, the MPS-21 is an advanced example of U. S. capability today in the critical area of tactical early warning.

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For more than a quarter century, Hallicrafters has worked in close partnership with our armed forces on fast solutions to critical military electronics problems. Out of this priceless experience are emerging startling new ideas and hard-hitting, fast-moving techniques to keep our country one jump ahead in electronic warfare . . .

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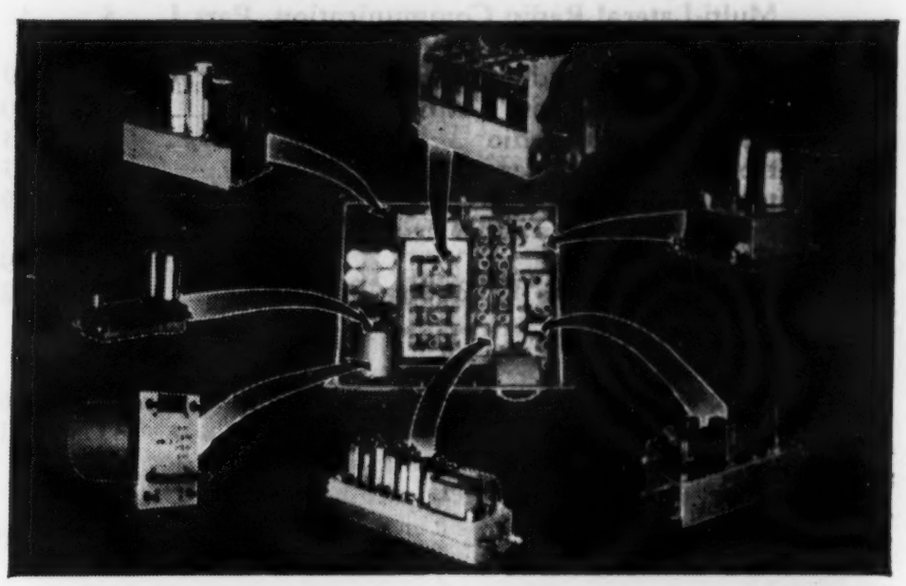

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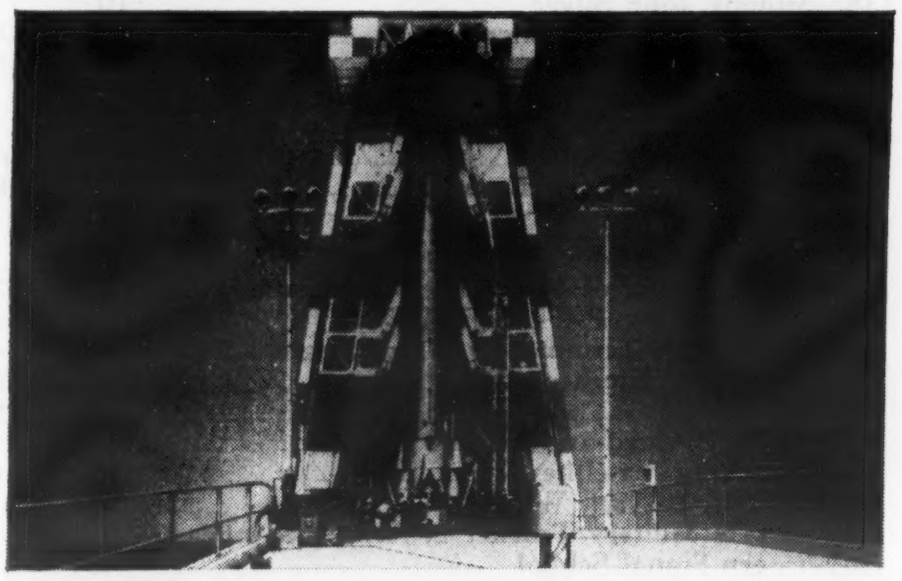
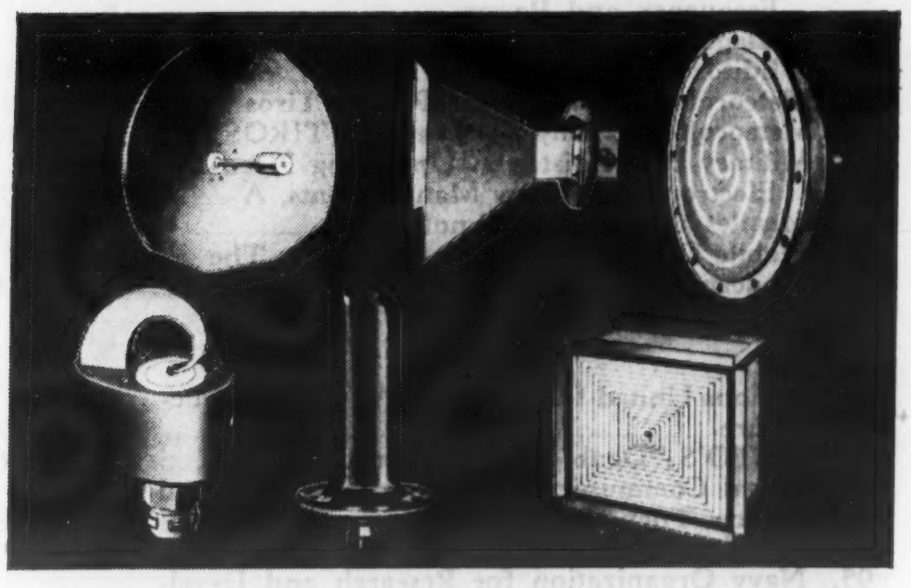


Hallicrafters participation in the Atlas missile project helped to develop capability for many areas of the complex missile field, including code translator data systems; ground support equipment; ECM testing and antenna systems. Current explorations involve latest Infra Red techniques.



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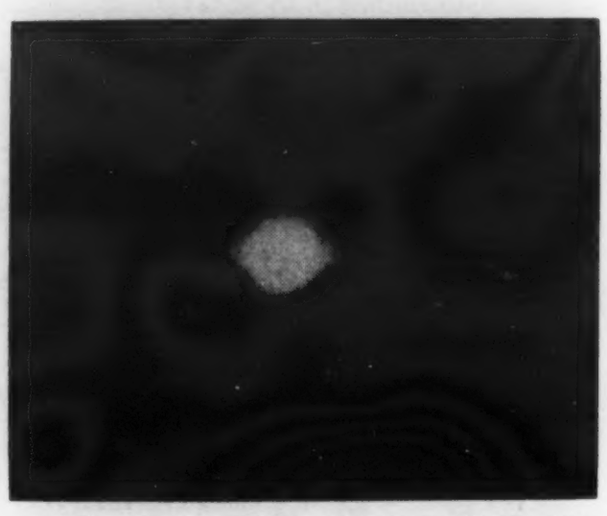
Photoprogress



Jonathan S. Blair—Dearborn Observatory

A Northwestern University student, nineteen year old Jonathan S. Blair, successfully made what is believed to be the first actual photograph of Echo I. Blair took the picture with a high-speed film at a speed of 1/100th second after 48 separate attempts, using a 135 millimeter lens through the 18.5 inch refractor telescope at the University's Dearborn Observatory.

All other known satellite photographs have been made with time exposures which provide photographic traces of the satellites.

Blair is a speech student at Northwestern. He is a member of the Moonwatch satellite tracking team at the observatory.

• • •

Photographs of the ultraviolet spectrum of the sun obtained last August by a U.S. Naval Research Laboratory Aerobee rocket fired at White Sands Missile Range, are expected to provide new data on the sun and its atmosphere.

The NRL, experiment, investigating solar radiation between the 2000 and 3000 Angstrom wavelength of the spectrum, represents the first time that this portion of the spectrum has been successfully examined in such detail. Photographs of the spectrum of this powerful ultraviolet radiation make possible a tremendous advance toward understanding the relationship between solar activity and its influence on the earth.

Launched from its pad in the New Mexico desert, the space vehicle soared over 90 miles into the atmosphere. As the Aerobee traveled upward, the rocket nose cone's pointing control system, developed by Aircraft Armaments Incorp. of Baltimore, kept the sun's radiation directed into the spectroscope. At different times during the flight, the ultraviolet-sensitive instrument took photographs of the sun's spectrum at various exposure lengths. As the rocket was pulled back to earth by gravity after accomplishing its mission, the nose cone separated from the main section and parachuted to the ground.

Basically, the spectrographic equipment used in the experiment consisted of a specially-treated diffraction grating (a reflecting and dispersing surface), a prism and several lenses. The ultraviolet rays, separated from other solar radiation upon entering the optical instrumentation, were focused on a minute slit (approximately 6/10,000 x 14/1,000 inches). Directed into a lens system, these light rays were separated into their component wavelengths by a prism. Passing on to the grating, the wavelengths of the ultraviolet light were dispersed even further and bounced back through the prism. Returning through the lens system, the spread-out light was focused onto 35mm film.

• • •

Ansco, Binghamton, N.Y., the photographic manufacturing division of General Aniline & Film Corp, has developed an automatic recording Microdensitometer. The instrument was developed for measuring and recording transmission and reflection densities of micro images in the field of photography and the graphic arts where critical measurements of acutance, granularity, resolution and related studies are essential to the evalulation of image quality.

The Microdensitometer consists of a traveling stage projection microscope with a photomultiplier tube for measuring the light in the projected image. The limiting aperture, which can be adjusted to determine the reading area in the projected image plane is immediately in front of the phototube. The phototube is operated in conjunction with an Ansco Model 12A Densitometer circuit providing an output linear with optical density which is recorded on a strip chart recorder.

The stage is driven through a micrometer system by an electrically selected gear train. This unit is powered by motors operating through electrical clutches which provide a versatile stage speed range. A system of electrically inter-locked push button controls facilitates convenient finger-tip operation.

Names in the News

W. Walter Watts has been elected to the Board of Directors of the Radio Corporation of America. He will continue his duties as group executive vice president of RCA and chairman of the board and president of RCA Sales Corporation.

Jerome L. Strauss has been appointed vice president and general manager of Budd Electronics, Inc., a subsidiary of the Budd Company. He joined the company in 1946 as sales manager and in 1950 was appointed vice president for marketing.

Dr. Alfred K. Wright, vice president of operations, Tung-Sol Electric Inc., has been elected to the company's board of directors. He joined the firm in 1937 and has held a succession of managerial posts including vice president in charge of engineering.

Dr. Edward G. Witting was elected national chairman of the Professional Group on Military Electronics of The Institute of Radio Engineers. He is Deputy Director of Research and Development, Department of the Army. a position he has held since 1956.

William E. Burke, vice president of the Defense Projects Division of Western Electric Company, Inc., will become vice president of the company's Installation Organization, November 1.

Captain W. L. Kitch, USN, has been assigned to the Office of Naval Communications as special assistant for Administration.

Rear Admiral H. C. Bruton, USN (Ret.) has been named vice president-planning for the Military Products Division of Hoffman Electronics Corporation. He is a former national vice president of the Association.

Cadet Peter Buttner, Massachusetts Institute of Technology, won the AFCEA Award at the 1960 ROTC Summer Camp at Fort Gordon, Ga.

Herbert H. Rosen, former deputy director of the Office of Public Information of the National Aeronautics and Space Administration will be Director of Public Relations at Hoffman Electronics Corp. in California.

Dr. Arthur Goldsmith has been appointed director of engineering of Wilcox Electric Company, Inc.

M. C. Richmond, manager, Government Relations, Defense Activities Division, Western Electric Company, has been elected president, Washington Post of the American Ordnance Association. He is a former treasurer of AFCEA.

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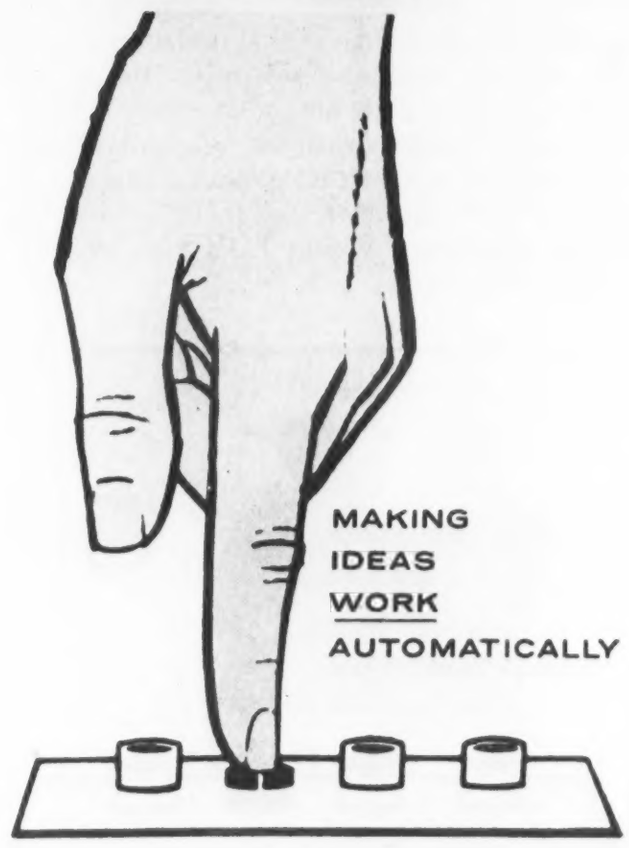

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Personnel Available

As a service to AFCEA members, SIGNAL will make space available in this column for those members who are interested in employment in the communications, electronics and photography industries. Any member is entitled to three insertions in the magazine on a space available basis, free of charge. Please limit your notice to 5 lines. In replying, employers are asked to address: Box ——, SIGNAL, 1624 Eye St., N.W., Washington 6, D. C. Letters will be forwarded to the AFCEA member.

COMMUNICATIONS ENGINEER with twelve years' knowledge of Japanese governmental and industrial communications desires position in Japan. Fluent Japanese, MS Business Administration. Capable sales and engineering-administrative management. Box 158.

TELECOMMUNICATIONS ENGINEER 12 years' experience in microwaves, troposcatter, VHF radio, electric utilities communications systems. Seeks position similar fields or sales with manufacturer, consulting engineer or private system. Box 159.

ELECTRICAL ENGINEER seeks position in communications work. Three years broad design, manufacturing experience in receiver, transmitter and telephone. Two years AACS Maintenance Officer. Salary open. Location Midwest. Box 160.

EX-MILITARY OFFICER desires position in civilian company. Signal Corps officer with two years' experience in fixed station radio equipment and management. B.S. in Business Administration. Salary and location open. Box 161.

FIELD SERVICE ENGINEER with four years' experience in tropospheric scatter and other phases of communications seeks position in Europe. First-class FCC License, speaks French. Presently resides in Paris. Box 162.

CONTRACT'S ADMINISTRATOR with electronics background seeks permanent position within the electronics industry. Experience with customer relations. Familiar with composition of contractual documents, contract administration, proposals coordination, engineering and project planning. Holds TOP SECRET security clearance. Box 163.

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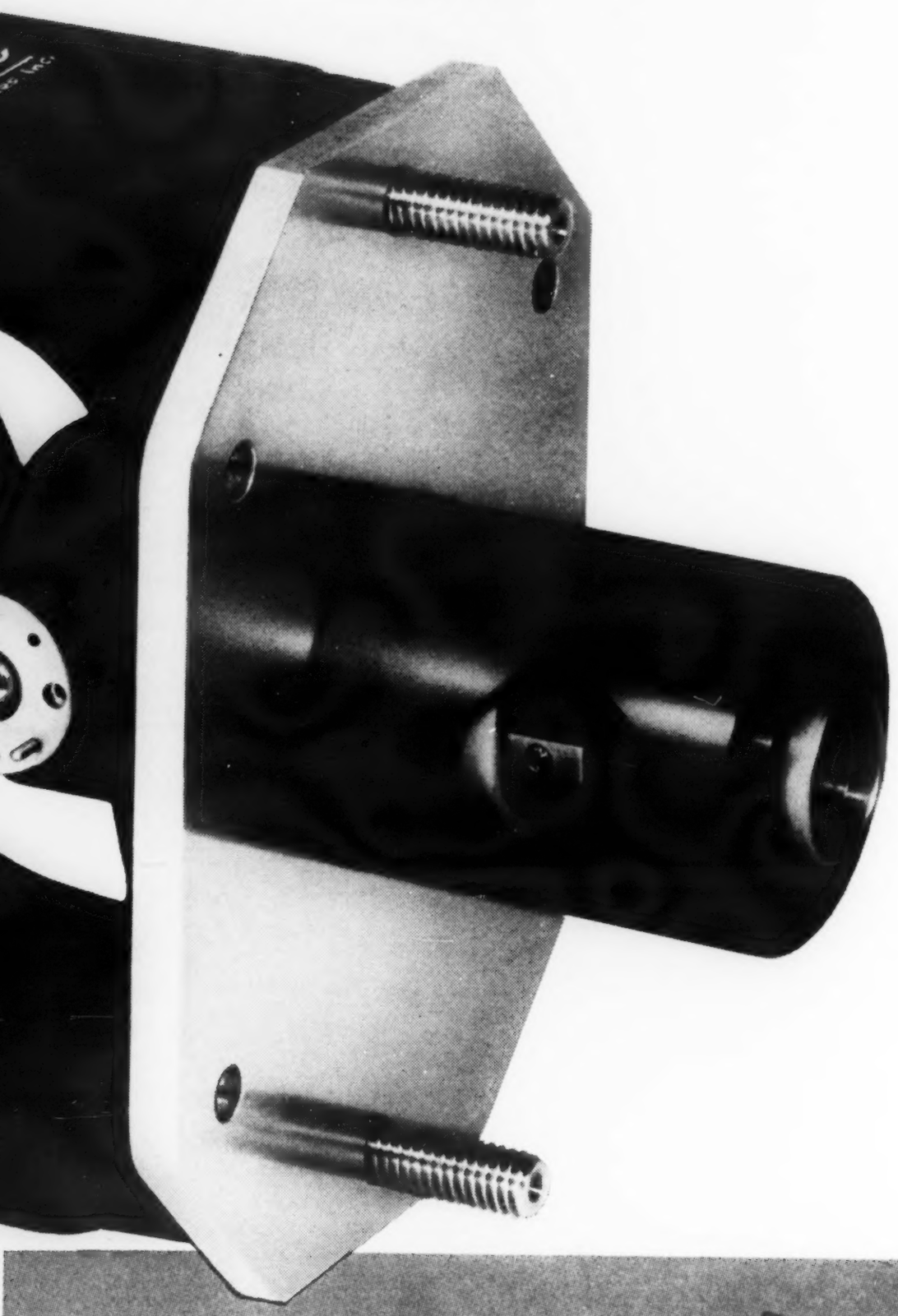

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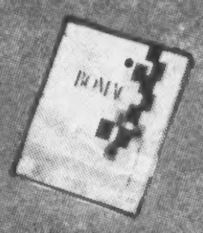

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